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**Catalog of Absolutely Calibrated, Range
Normalnized, Wideband, Electric Field Waveforms
from Located Lightning Flashes in Florida**

Volume II: 8 and 10 August 1985 Data

**Yutaka Izumi
John C. Willett**

12 April 1991

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13. ABSTRACT (Maximum 200 words) During the summers of 1985 and 1987, field experiments were conducted at the NASA Kennedy Space Center, Florida, to measure electromagnetic fields produced by lightning. This is the second data report resulting from these experiments. It presents plots of range-normalized waveforms for all offshore located lightning events recorded during two storms on 8 and 10 August 1985. The storms in the first data report occurred on 24 July and 14 August 1985. The events are classified into categories according to the general characteristics of the waveforms. The waveforms presented are the electric field, time derivative of the electric field, and high frequency energy spectral density.				
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Preface

We thank Mr. J. C. Bailey, who wrote most of the data-analysis software, for consultations during the preparation of this report. Lightning locations were kindly provided by Prof. E. P. Krider. These data were collected in the field by Prof. C. Leteinturier. The site support provided by Mr. W. Jafferis was essential to the successful field deployment. The experiments were carried out while the second author was at the Naval Research Laboratory, Washington, DC, supported in part by AFOSR contract F49620-86-C-0013.

1. INTRODUCTION

During the summers of 1985 and 1987, field experiments were conducted at the NASA Kennedy Space Center (KSC), Florida, to make quantitative measurements of electromagnetic fields produced by lightning. The experimental site was located close (44 meters from mean high water) to the Atlantic Ocean so that the field produced by any discharge over the ocean could be detected with minimum distortion due to ground-wave propagation. Detailed descriptions of the site, instrumentation trailer, equipment, data acquisition system, and experimental and calibration procedures are provided by Bailey and Willett¹; Willett, Bailey, and Krider²; and Willett et al³. Discussions of locating the lightning discharges by a magnetic direction-finding network and selecting them by range and by azimuth are also included in these papers.

The report by Bailey and Willett¹ was the first data report resulting from these field experiments. It presented plots of range-normalized waveforms for offshore lightning events recorded during two storms on 24 July and 14 August 1985. These events were classified into 15 categories, and the general characteristics of the waveforms that identify the event types, as well as specific descriptions of each event type, were discussed.

This report follows the above as Volume II of the series. The two storms in this report occurred on 8 and 10 August 1985. The data plots presented here use formats that are identical to those in the first report, and the discussions that complement the figures will also be similar to the first report.

2. STORMS OF 8 AND 10 AUGUST 1985

Absolute calibration of the radiation-field magnitudes from lightning discharges requires knowledge of the discharge location. This requirement limits the data to either cloud-to-ground (CG) flashes, which are located by the direction-finding network, or intra-cloud (IC) flashes occurring in a localized storm so that the range can be estimated. All of the data in this report are collected from the CG flashes.

All the locations of ground-strike points of cloud-to-ground flashes determined by the magnetic direction-finding network during the period 1914-2044 UT on 8 August are shown in Figure 1, and those for the period 1640-1740 UT on 10 August in Figure 2. Only discharges at ranges within 50 km from the site and at azimuths greater than 10° from the shoreline were considered for this report. Thus, all waveforms displayed here were produced by discharges confined within the NNW to SSE sector within a radius of 50 km from the site. With these limitations, a total of 94 flashes for 8 August and 31 flashes for 10 August were recorded. The distances of the strikes during the 8 August storm varied from 5.3 to 22.0 km with an average of 11.5 km during the first half and from 23.5 to 49.6 km with an average of 31.8 km during the latter half. For the 10 August storm the distances varied from 1.9 to 19.1 km, and the average was 10.0 km.

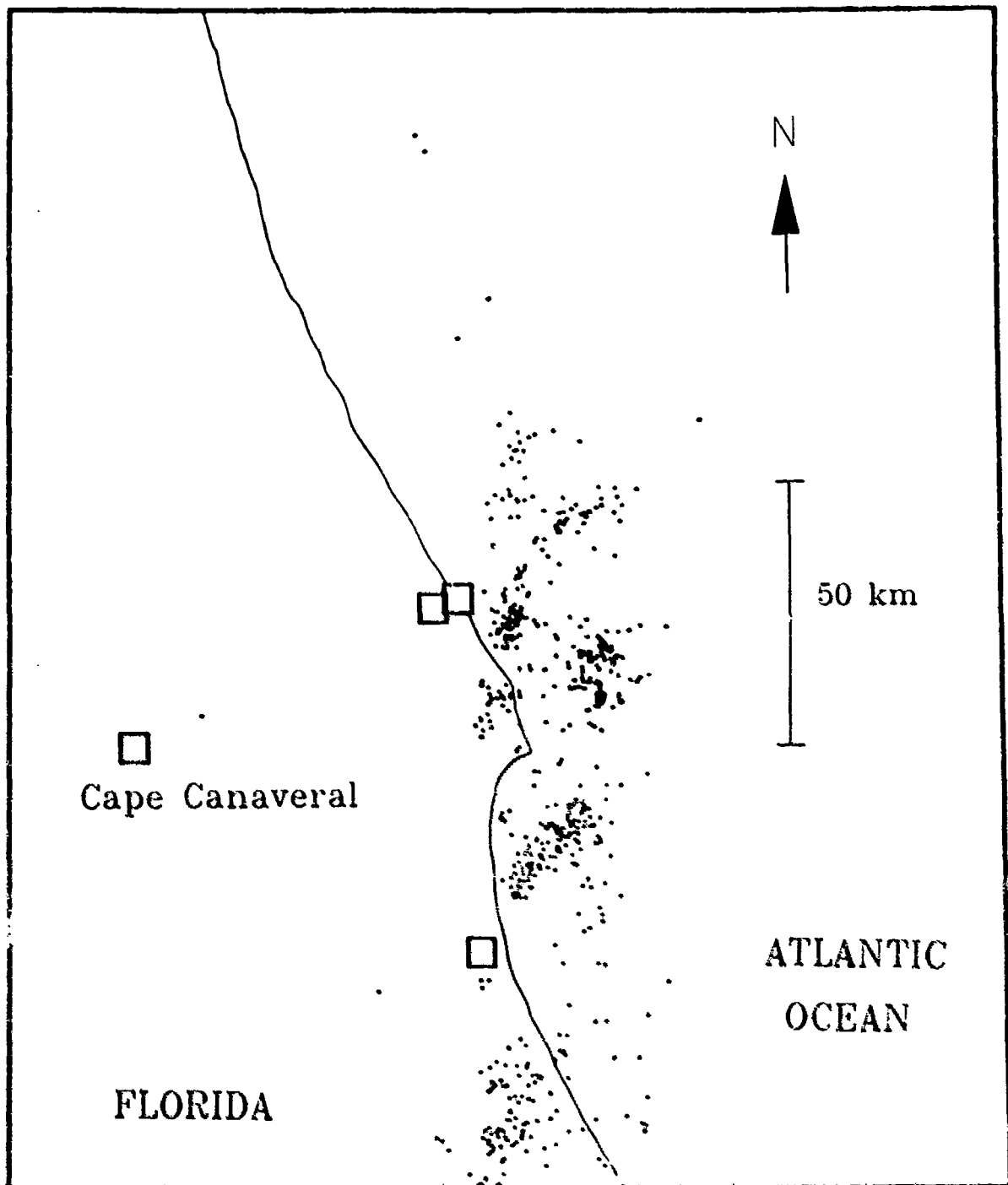


Figure 1. The Locations of Ground Strike points of Cloud-to-ground Flashes Determined by the Network of Magnetic Direction Finders During the Period 1914-2044 UT on 8 August 1985. The northeastmost open square represents the location of the instrumentation trailer on the east coast of the Florida peninsula, and the other open squares represent the three direction finders in the network

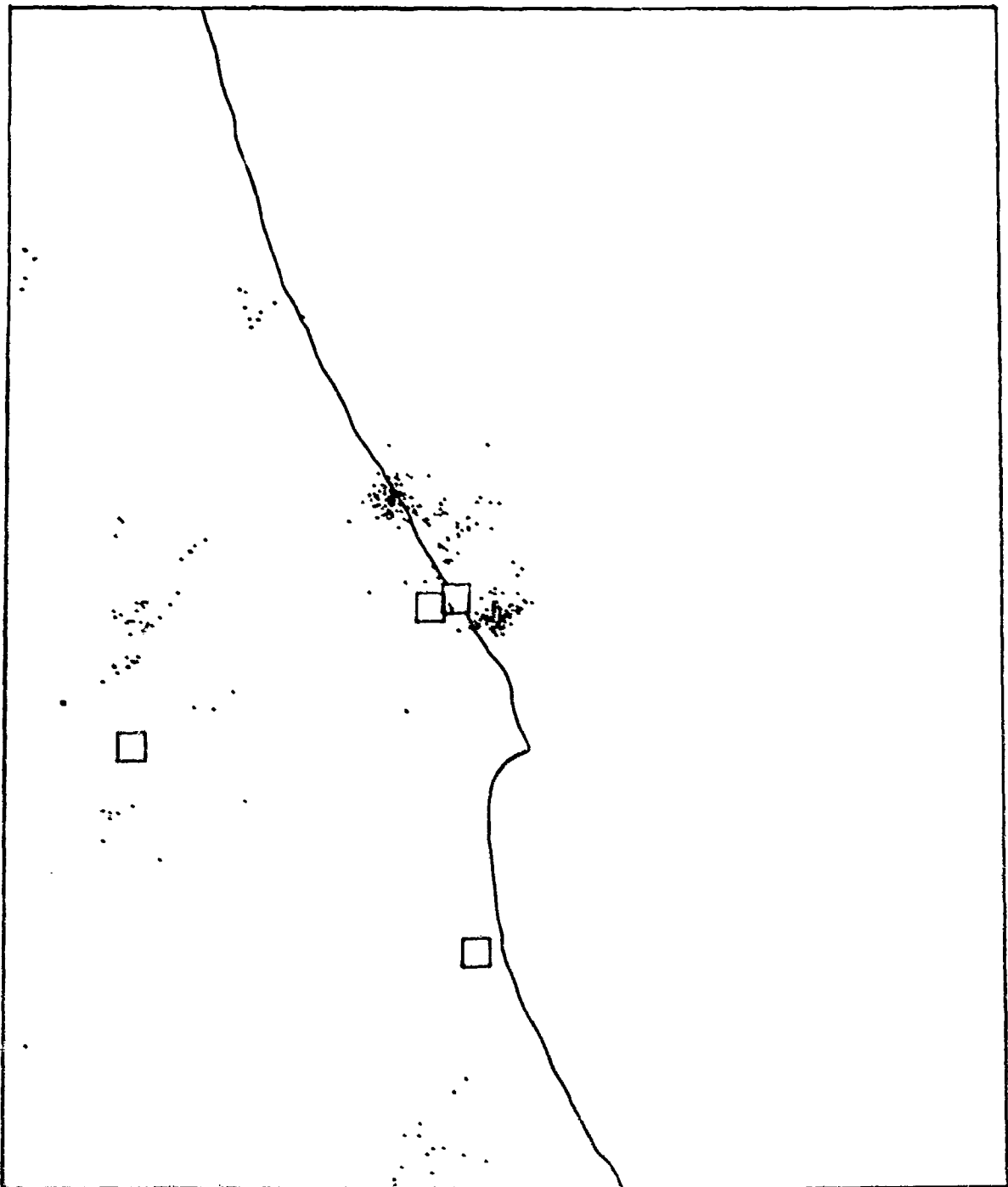


Figure 2. The Locations of Ground Strike Points of Cloud-to-ground Flashes Determined by the Network of Magnetic Direction Finders During the Period 1640-1740 UT on 10 August 1985. The squares have the same representation as in Figure 1

3. DATA PLOTS

The plots for 8 August and 10 August are shown in Appendixes A and B, respectively. As described by Bailey and Willett¹ and Willett et al², the data-acquisition system records an entire lightning flash with moderate time resolution as well as several of the impulsive events within the flash with much higher resolution. The high resolution data were obtained from triggered digitizers sampling the "fast electric field" (fast E) and high frequency energy spectral density (fast HF) at 10^7 samples per second and the time derivative of electric field (dE/dt) at 10^8 samples per second. The duration of a single lightning flash was defined by two slow digitizers that sampled the "slow electric field" (slow E) and the peak HF energy spectral density (slow HF) at 2×10^4 samples per second for a period of 1.075 sec starting 403 msec before the first trigger.

The high resolution data for each located trigger event is represented by a "fast page" in the appendixes. Each fast page uses the same format. The title line consists of the date/time group, the event type, and, enclosed within parentheses, the range in km. The date/time gives the time of the trigger. For example, the first date/time given in the appendixes is 220191408.104, which denotes the Julian date of 220, 19th hour, 14th minute, and 08.104 seconds. The time used in all the figures is the universal time (UT); four hours must be subtracted to convert to Eastern Daylight Savings Time. On the left side of the fast page are plotted the fast E ($V m^{-1}$) waveform at the top and the fast HF ($V m^{-1} Hz^{-1}$) waveform at the bottom, both at a resolution of 100 nsec per sample for a total time of 0.4096 msec. On the right side are plotted the dE/dt ($V m^{-1} \mu sec^{-1}$) waveform at the bottom, at a resolution of 10 μsec per sample for a total time of 40.96 sec, and the corresponding portion of the fast E waveform (magnified) at the top.

The fast pages for a given flash are followed by a "slow page," which shows the context of each event within the entire flash. The slow page title line contains the start time of the record, the date, and the range in parentheses. The slow E ($V m^{-1}$) waveform is at the top, and the slow HF ($V m^{-1} Hz^{-1}$) waveform is at bottom, both at a resolution of 50 μsec per sample for a total time of 1.075 sec. The trigger times for the fast events are indicated by tick marks beneath the slow HF record.

At this point several comments should be made regarding the data. The figures in the appendixes are identified by the event time rather than by figure number. The linear scales of the ordinates can vary from plot to plot, since a scale appropriate to the individual waveform is selected. When the digitizers are saturated, the saturation levels are indicated on the plots by dashed lines. The sign convention used throughout the report is the normal physics convention. That is, an upward electric field is produced by negative charge overhead and is positive. A normal return stroke that lowers negative charge to Earth thus produces a negative field change.

It should also be mentioned that, because of the nature of the fast and slow integrators, there is no absolute electric field zero. For this reason, and also to remove any electronic zero drifts from the data, zeros were computed numerically from each record. The fast and slow HF zero levels were set to the minimum value of the respective HF record. The slow E zero was

equated to the average of the maximum and minimum values. The other two zero levels were determined by dividing the full records into four quadrants of identical length. The fast E zero level was equated to the average of the first quadrant, whereas the dE/dt zero level was taken as the average of the first and fourth quadrants.

Assuming that the waveforms are primarily radiation field and hence retain their fundamental shape as a function of distance, all plots except the slow electric field (mostly electrostatic) have been range normalized to 100 km. For some of the closest flashes, this assumption may be invalid. The original data can be reconstructed by multiplying the fast E and dE/dt waveforms by (100 Range^{-1}) , multiplying fast and slow HF by $(100 \text{ Range}^{-1})^2$, and leaving the slow E alone.

Most of the data in this report were obtained with the digitizers triggered by the fast HF signal. The HF receiver frequencies and the trigger thresholds, in $(\text{V m}^{-1} \text{ Hz}^{-1})^2$ at the site location (not range normalized), for both data sets are given in Table 1. Each table entry is correct up till the time of the next entry. In two cases the digitizers were triggered by the absolute value of the fast E signal, as indicated in the table, with the trigger thresholds in (V m^{-1}) at the site. The thresholds must be range normalized to 100 km by multiplying by $(\text{Range } 100^{-1})^2$ for fast HF, or by $(\text{Range } 100^{-1})$ for fast E, for comparison with the data plots.

Table 1. HF Center Frequencies and Trigger Thresholds

Date	Time	Freq. (MHz)	Trigger Level (V m ⁻¹ Hz ⁻¹) ²
08/08/85	19:13:15	5	$1.18 \cdot 10^{-13}$
	19:15:10	5	$2.82 \cdot 10^{-13}$
	19:20:30	Fast E	34.2 V m^{-1}
	19:24:40	5	$1.18 \cdot 10^{-13}$
	19:40:00	5	$2.98 \cdot 10^{-13}$
	20:02:00	5	$2.98 \cdot 10^{-14}$
	20:04:30	5	$1.18 \cdot 10^{-13}$
	20:14:30	5	$2.98 \cdot 10^{-14}$
	20:21:00	10	$2.98 \cdot 10^{-15}$
	20:23:15	10	$7.45 \cdot 10^{-16}$
	20:32:00	10	$1.48 \cdot 10^{-15}$
08/10/80	16:19:50	Fast E	99.7 V m^{-1}
	16:19:50	5	$1.18 \cdot 10^{-12}$
	17:12:10	5	$2.98 \cdot 10^{-13}$
	17:27:15	5	$2.98 \cdot 10^{-14}$

One anomaly in the fast E plots also deserves comment. On three occasions, the sensitivity of the analog integrator was set too high, so that the signal approached its analog saturation level before the digital recording system saturated. In these cases a burst of oscillation was produced by the operational amplifier in the integrator as seen in events 220192144, 214, 222170427, 414, and 222170801, 103. While these bursts are unsightly, they do not affect the data at earlier times in the plots and, thus, can be ignored.

4. EVENT TYPES

In the first data report, Bailey and Willett¹ listed 15 categories of events. The categories, with the abbreviated forms used in the fast plots, are as follows:

1. First return strokes (1st RS)
2. Normal subsequent return strokes (Norm subs RS)
3. Dart-stepped subsequent return strokes (DS subs RS)
4. Chaotic subsequent return strokes (Chaotic subs RS)
5. Anomalous No. 1 return strokes (Anomalous No. 1 RS)
6. Anomalous No. 2 return strokes (Anomalous No. 2 RS)
7. Multiple ground return strokes (Multiple gnd RS)
8. Stepped leaders (Stepped leader)
9. Dart-stepped leaders (DS leader)
10. Chaotic leaders (Chaotic leader)
11. Dart leaders (Dart leader)
12. Characteristic cloud pulses (Char cloud pulse)
13. Narrow positive bipolar pulses (NPBP)
14. Narrow negative bipolar pulses (NNBP)
15. Unknown cloud pulses (Unknown cloud)

In the first report, all 15 event types were represented, and it was possible to discuss each type in detail. In the storms of 8 and 10 August we did not record any events in five of these categories. The numbers of the missing categories were 5, 6, 13, 14, and 15. The best represented event types were the first return strokes and the stepped leaders, categories 1 and 8, respectively.

It should be noted that the distinction among normal, dart-stepped, and chaotic subsequent strokes (Categories 2, 3, and 4) is somewhat subjective. Our criteria for these categories have evolved during the analysis so that we no longer agree with all of the identifications in the first report. Below is a list of category re-assignments for a few of the events in Bailey and Willett¹ to make them consistent with those in the present volume:

Date/Time	Old Category	New Category
226173540.063	DS subs RS	Norm subs RS
226173604.344	DS subs RS	Chaotic subs RS
226174631.769	Norm subs RS	Chaotic subs RS
226130000.396	DS subs RS	Norm subs RS
226181138.745	DS subs RS	Norm subs RS
226183452.177	DS subs RS	Anomalous No. 1 RS
226183627.775	DS leader	Chaotic leader

References

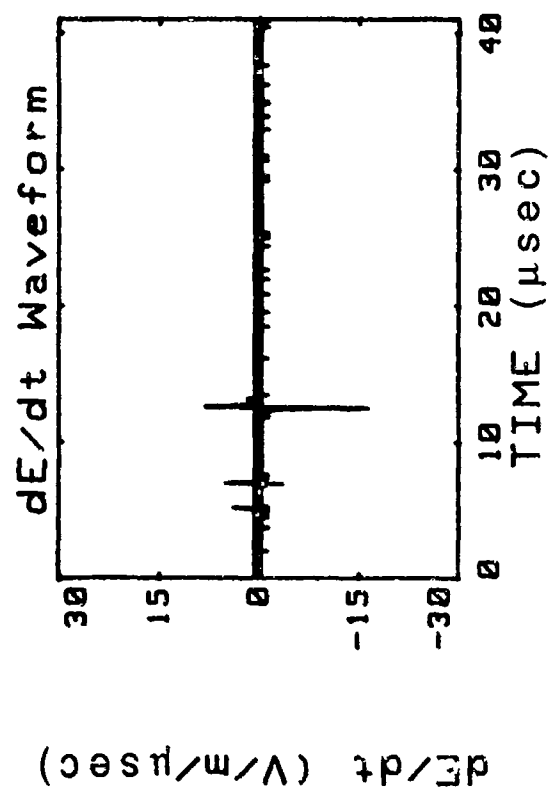
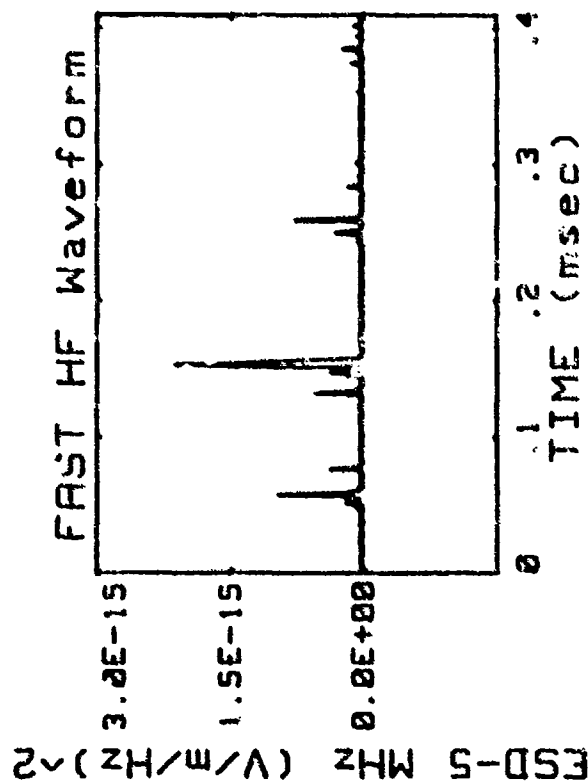
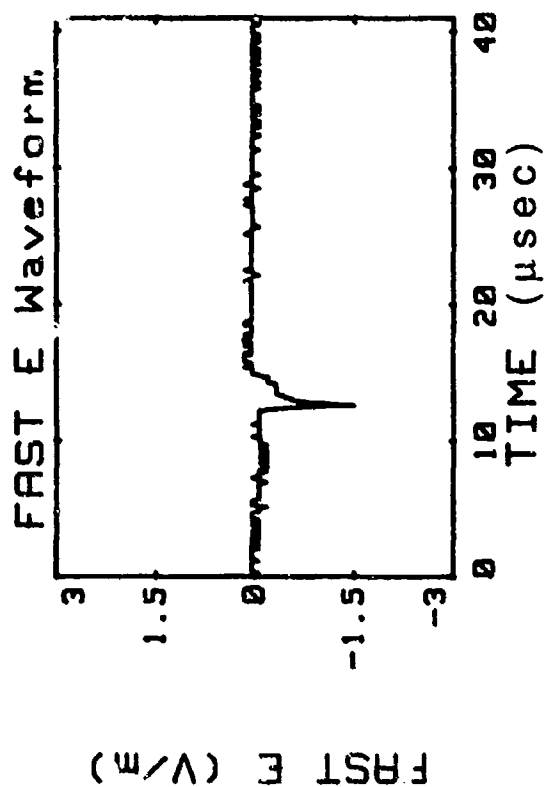
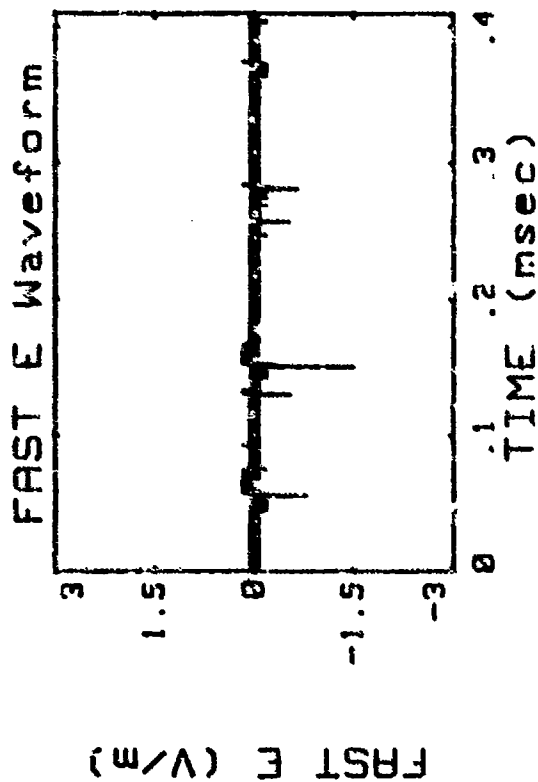
1. Bailey, J.C., and Willett, J.C. (1989) *Catalog of Absolutely Calibrated, Range Normalized, Wideband, Electric Field Wave forms from Located Lightning Flashes in Florida: July 24 and August 14, 1985 Data*, NRL Memo. Rep. 6497, Nav. Res. Lab., Washington, D.C. ADA212708
2. Willett, J.C., Bailey, J.C., and Krider, E.P. (1989) A Class of Unusual Lightning Electric Field Waveforms With Very Strong High-Frequency Radiation, *J. Geophys. Res.*, **94**:16,255-16,267.
3. Willett, J.C., Bailey, J.C., Leteinturier, C., and Krider, E.P. (1990) Lightning Electromagnetic Radiation Field Spectra in the Interval From 0.2 to 20 MHz, *J. Geophys. Res.*, **95**:20,367-20,387.

Appendix A

8 August 1985 Data Plots

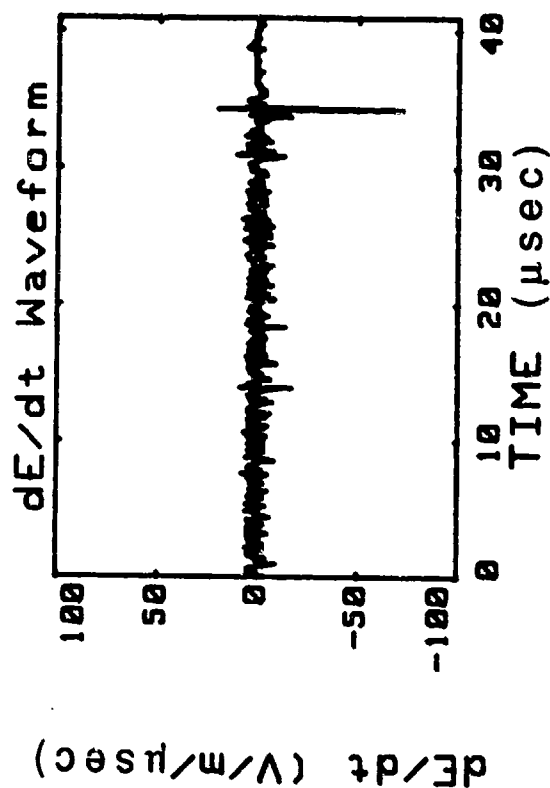
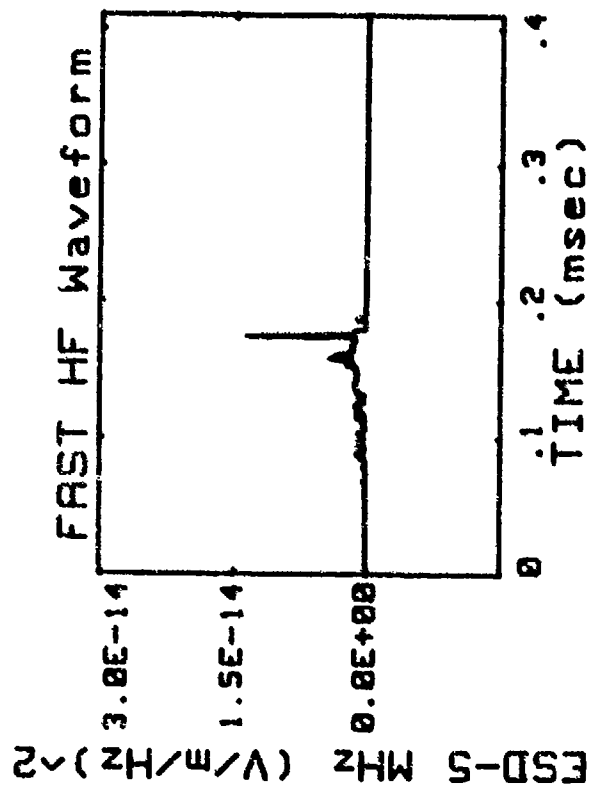
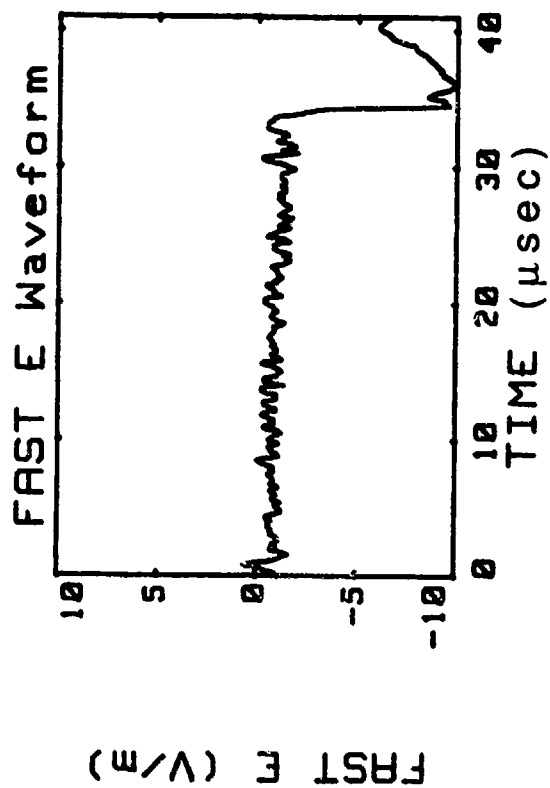
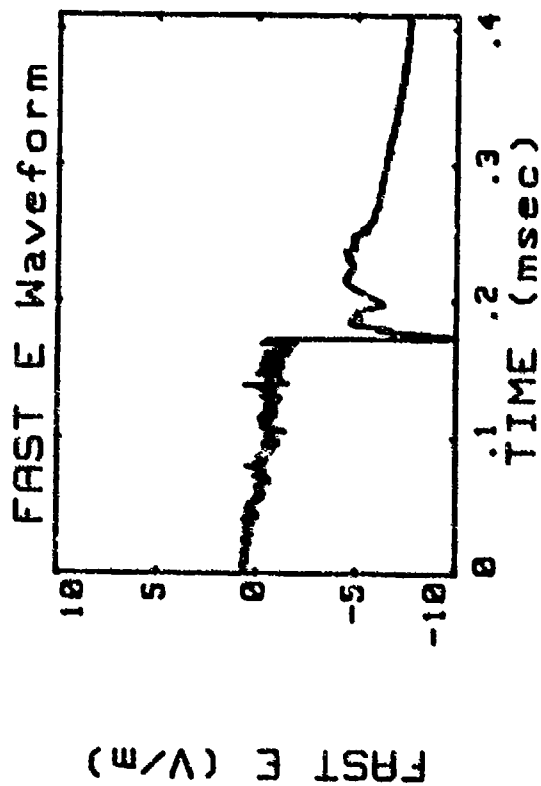
220191408.104 1985

Char Cloud Pulse (12.3 Km)



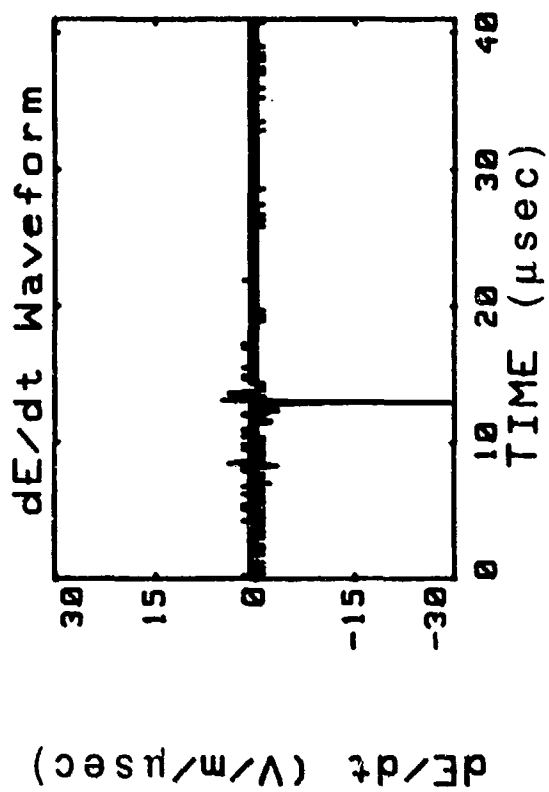
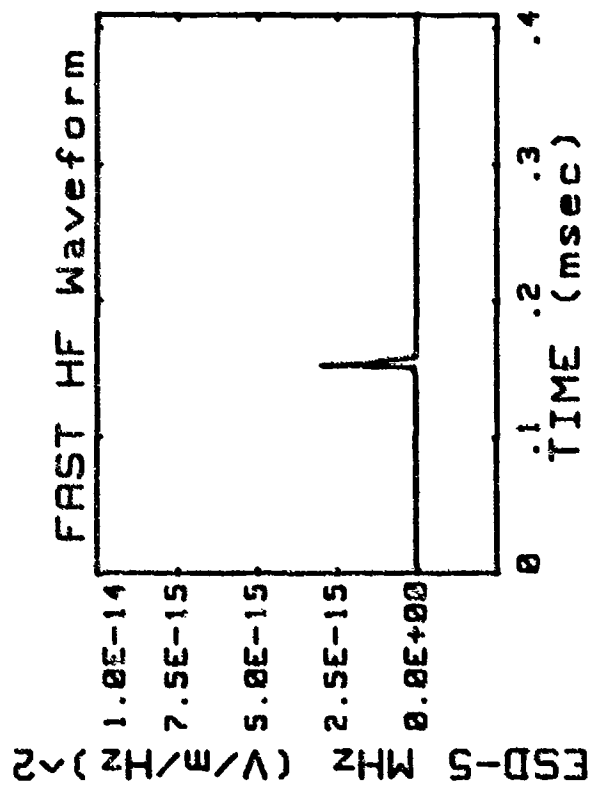
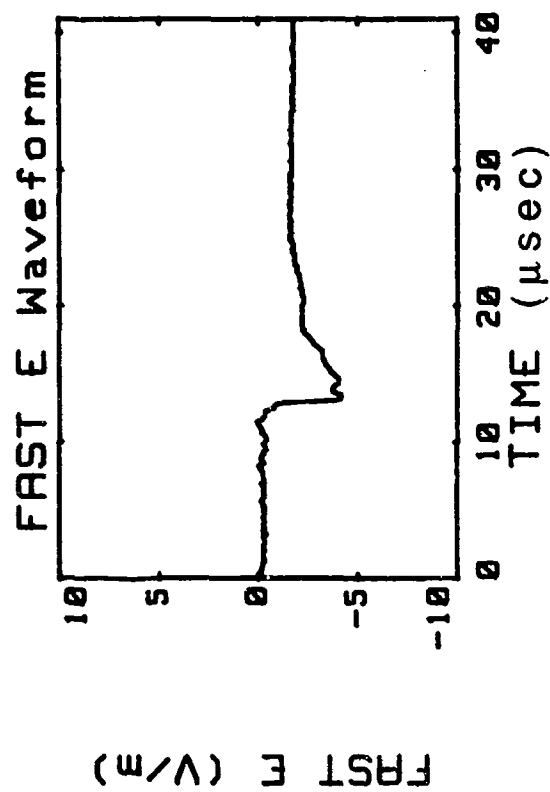
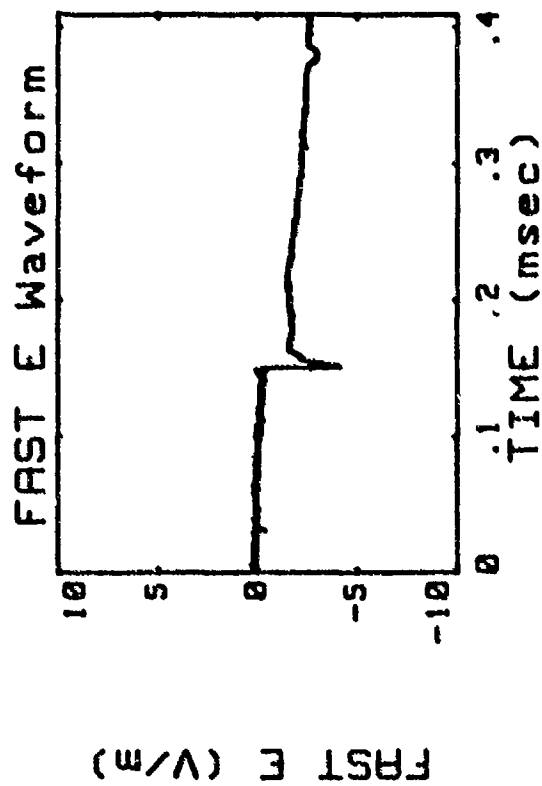
220191408.196 1985

Chaotic Subs RS (12.3 Km)



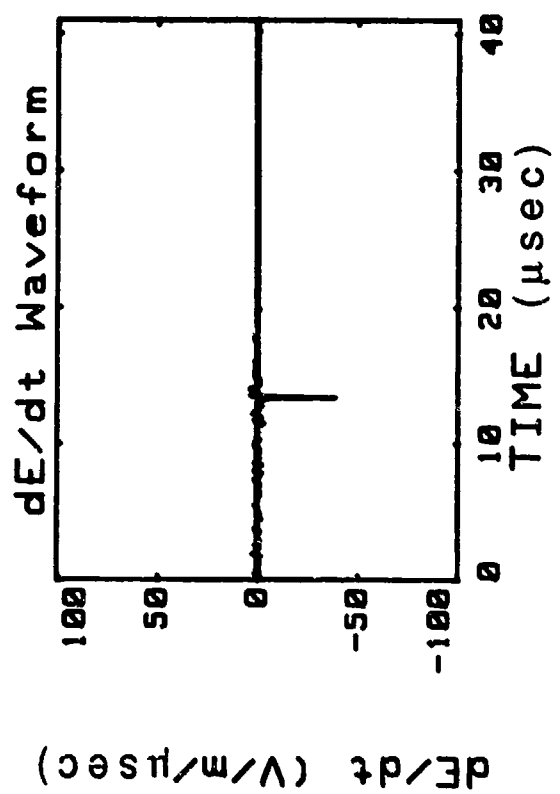
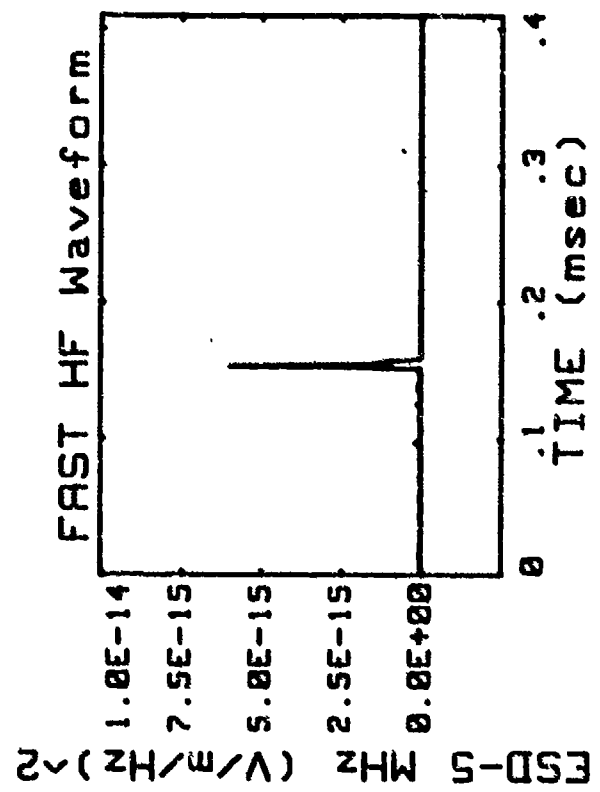
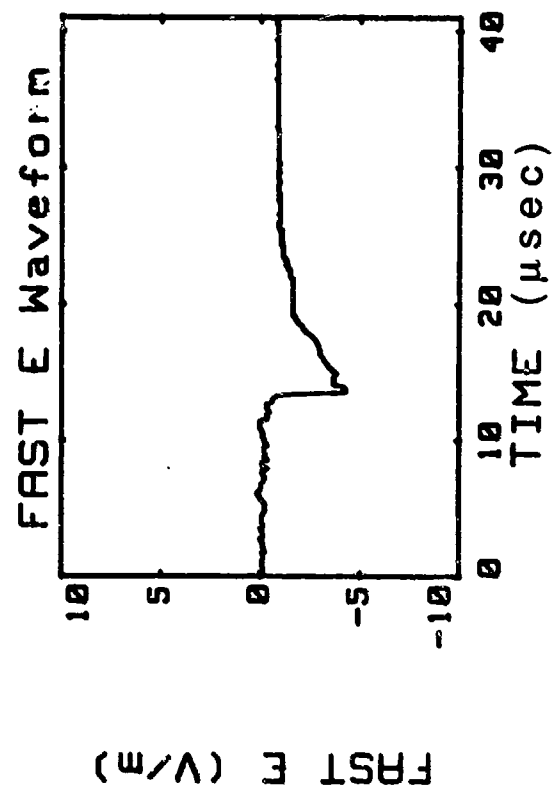
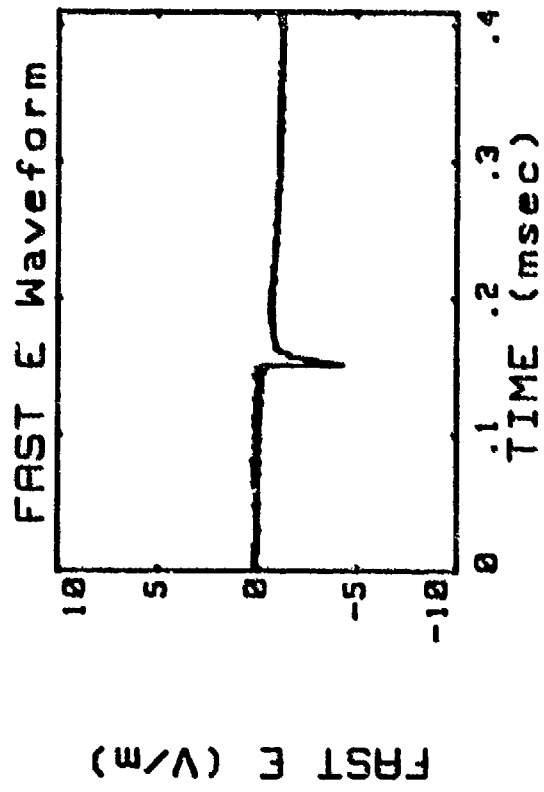
220191408.311 1985

Norm Subs RS (12.3 Km)

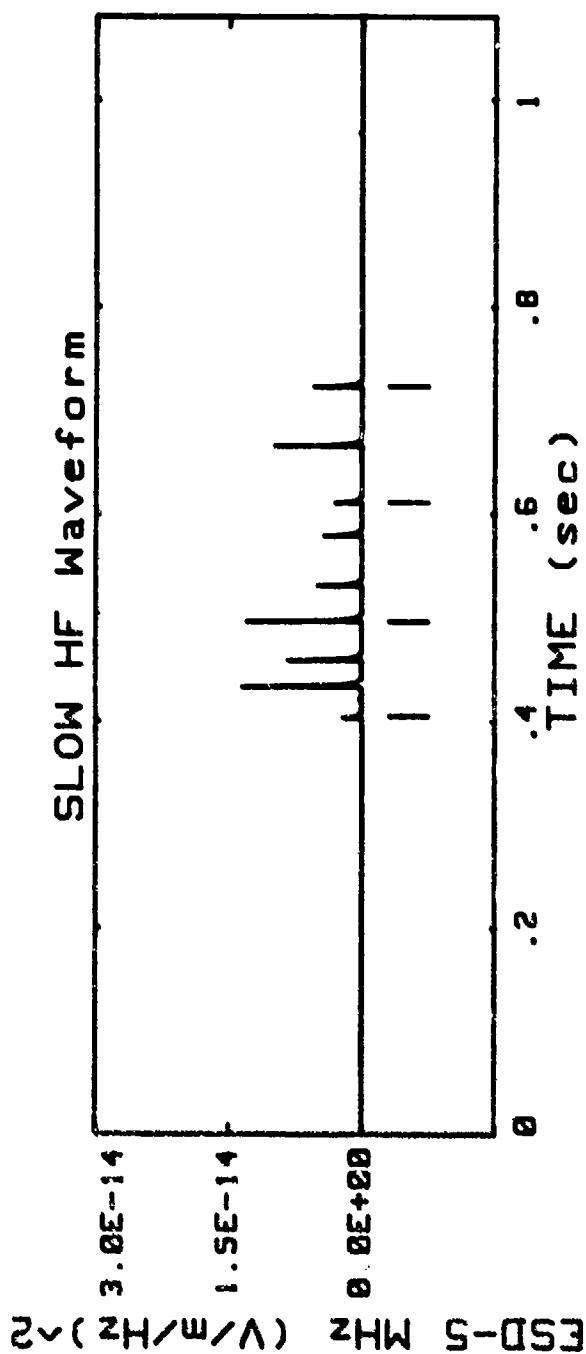
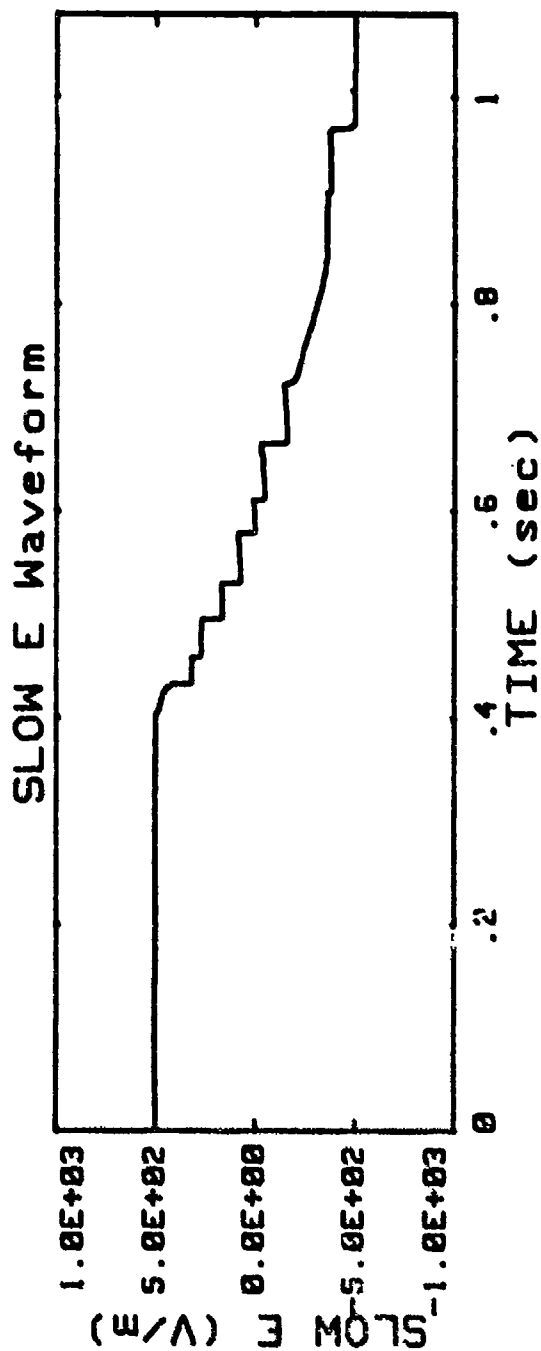


220191408.423 1985

Norm Subs RS (12.3 Km)

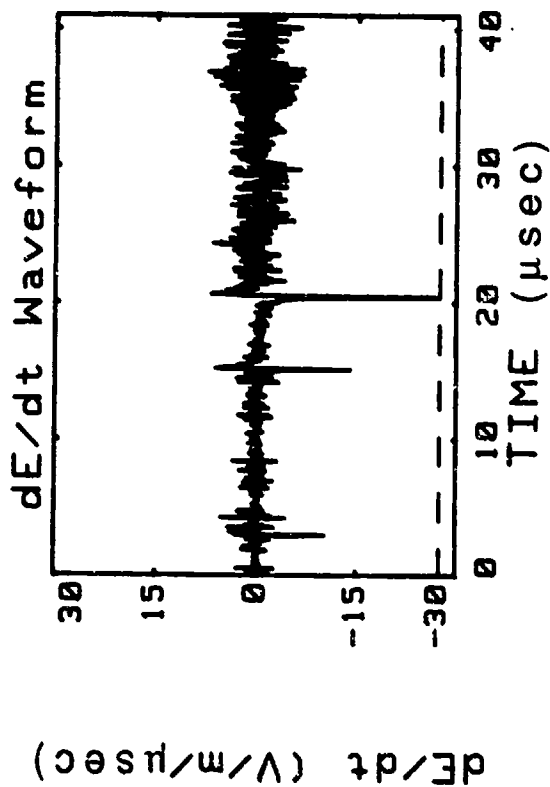
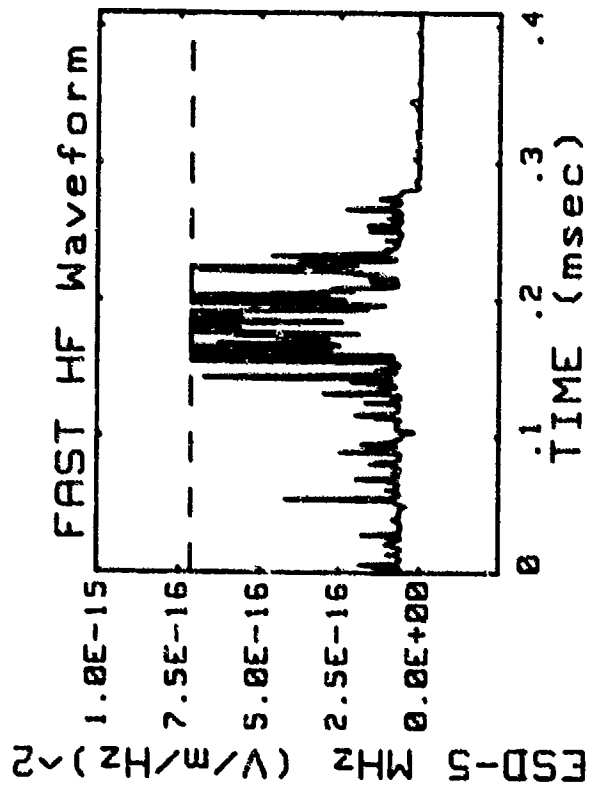
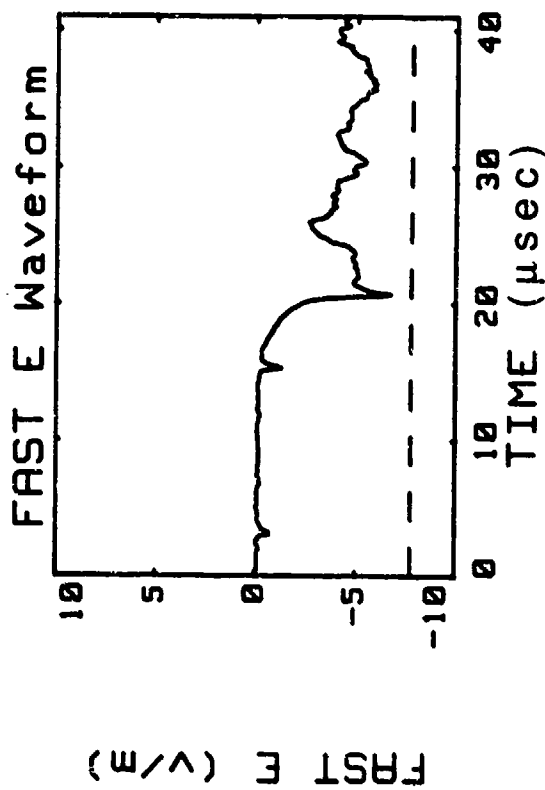
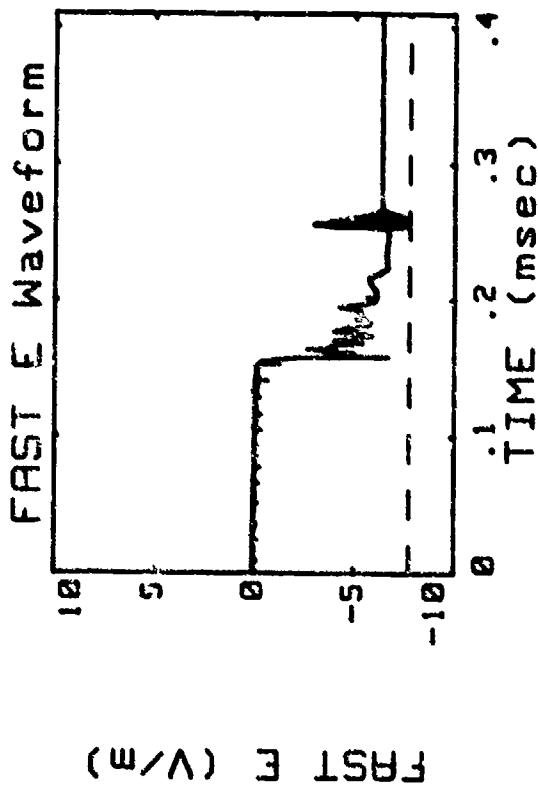


19:14:07.712 8 Aug 1985 (12.3 Km)

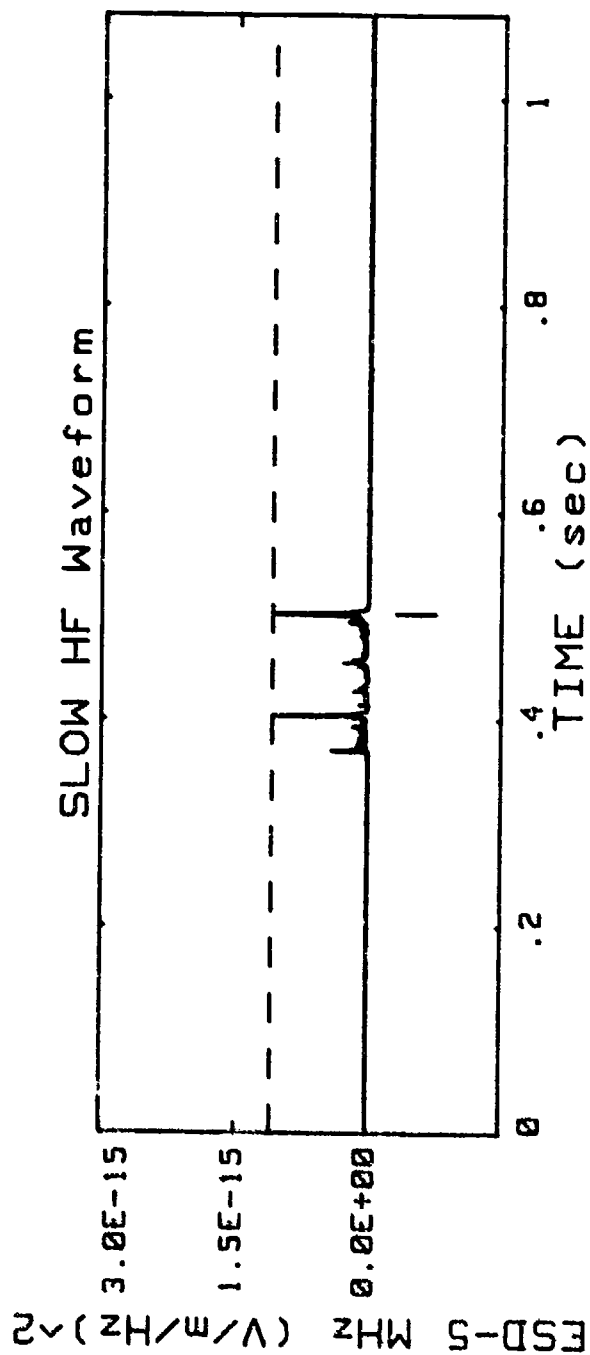
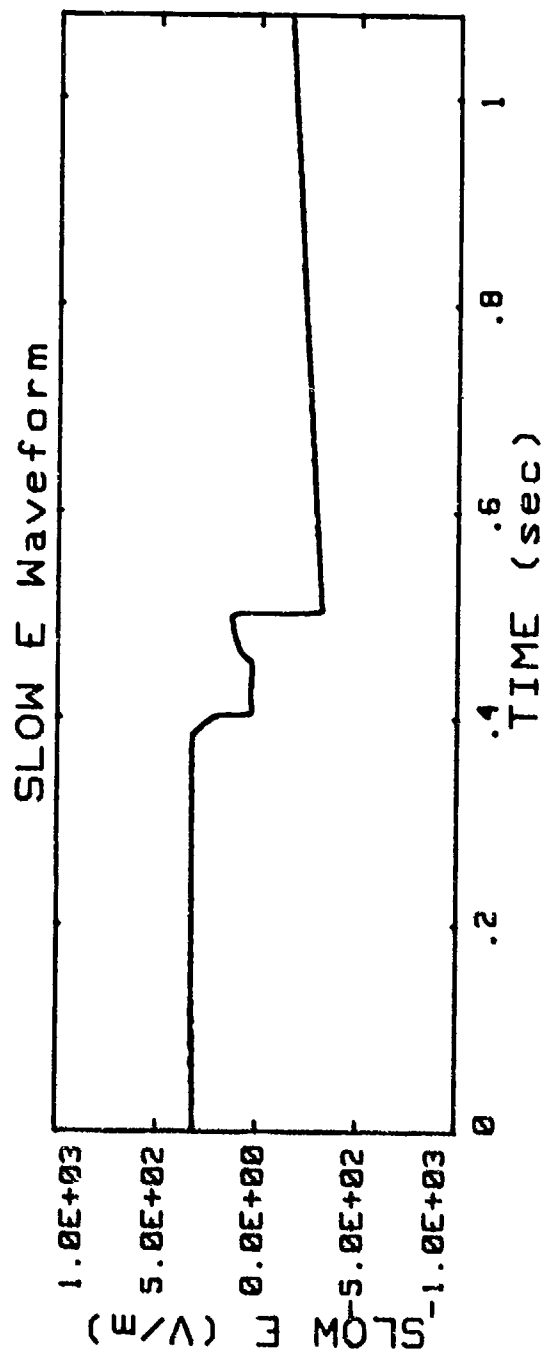


220192144.214 1985

Stepped Leader (5.3 Km)

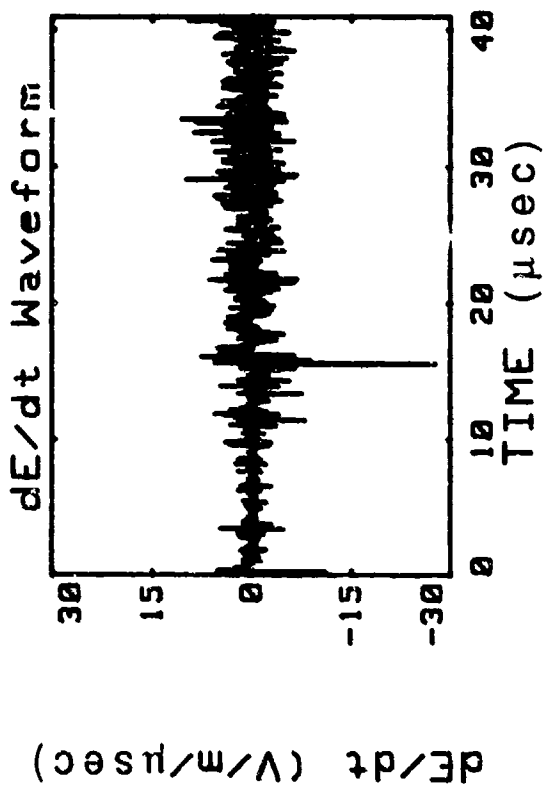
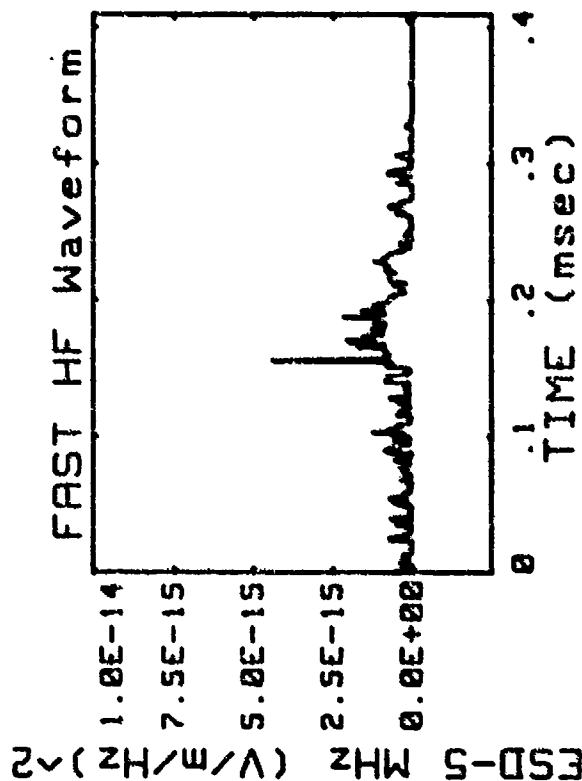
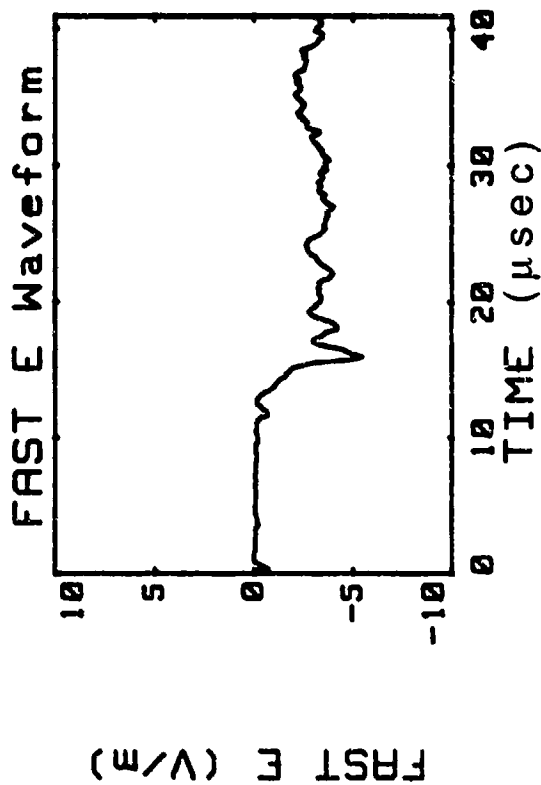
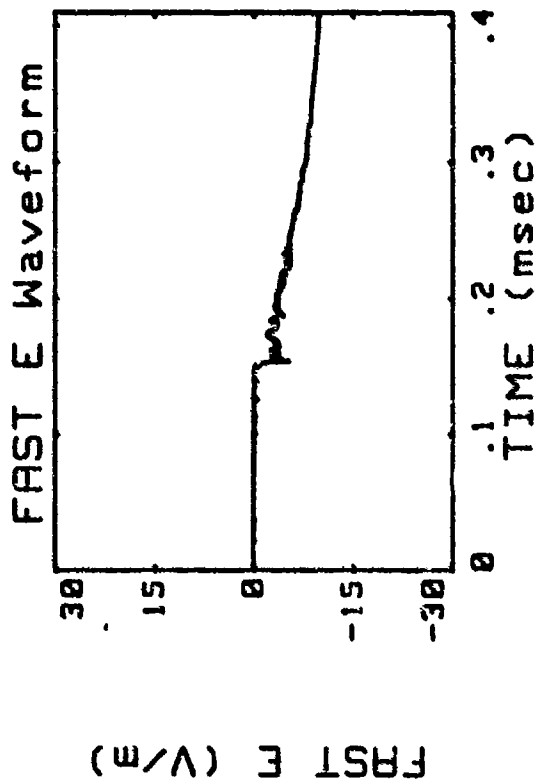


19:21:43.724 8 Aug 1985 (5.3 Km)

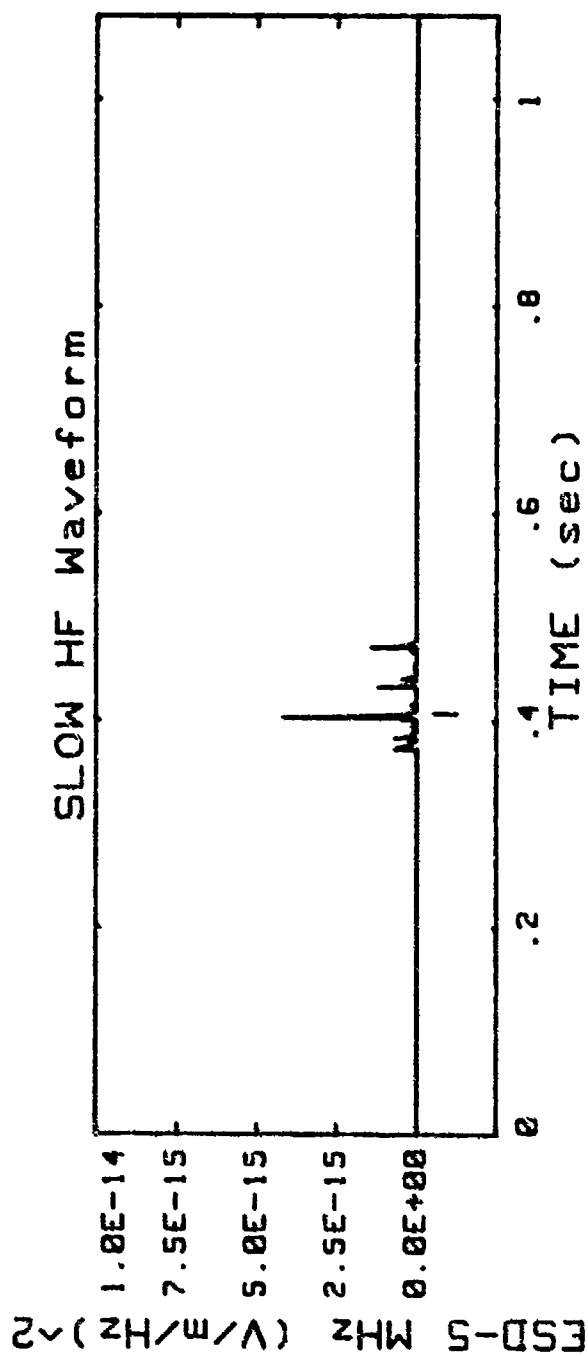
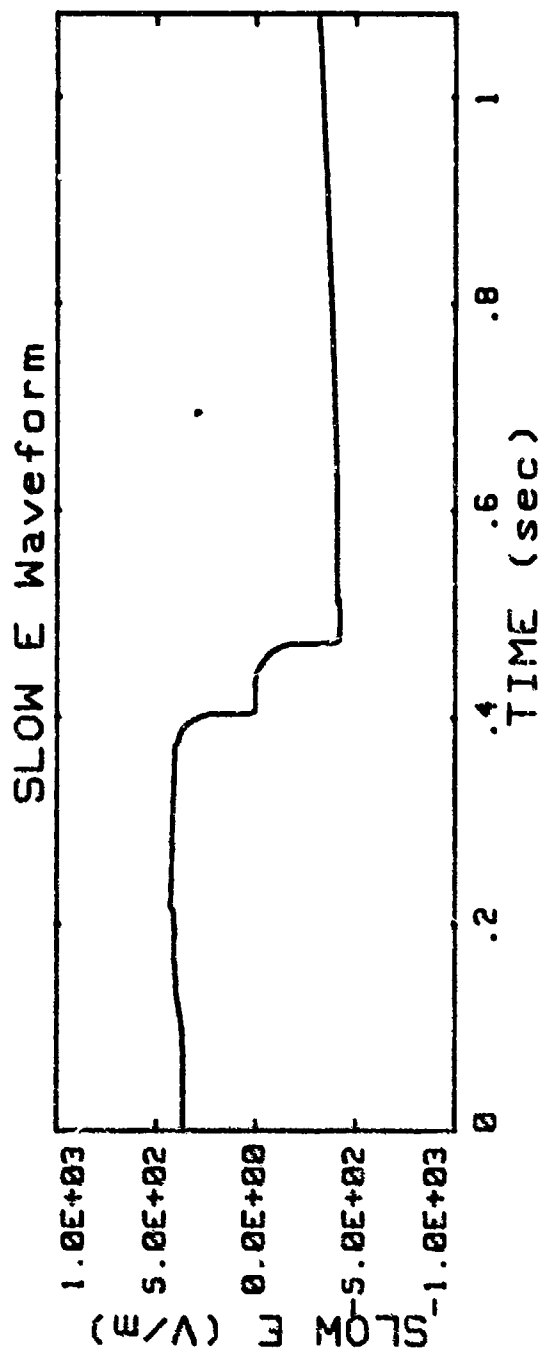


220192306.969 1985

1st RS (9.5 Km)

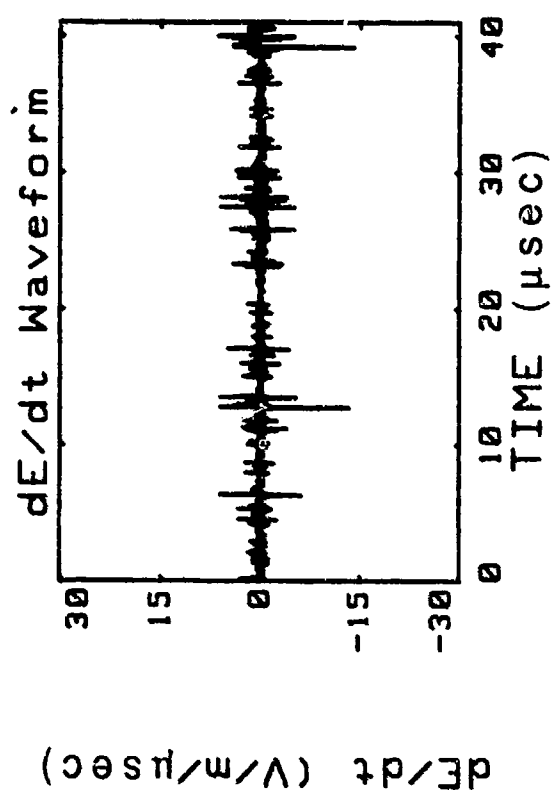
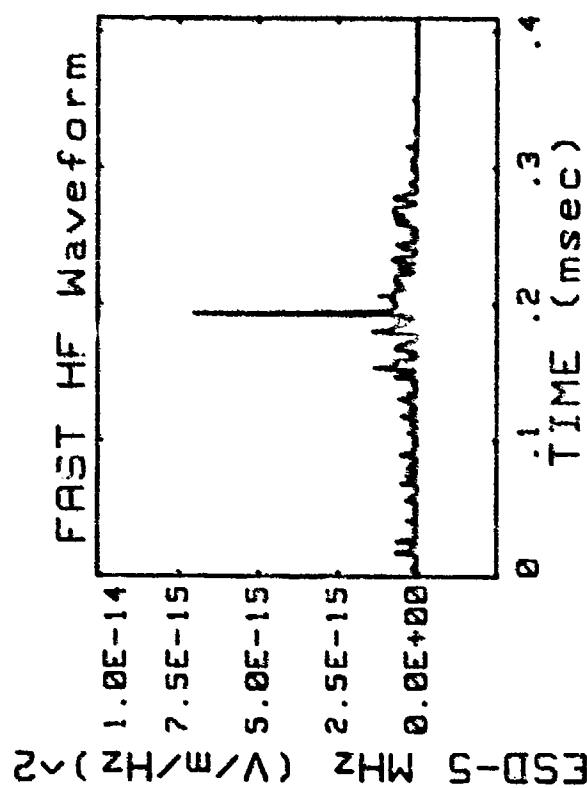
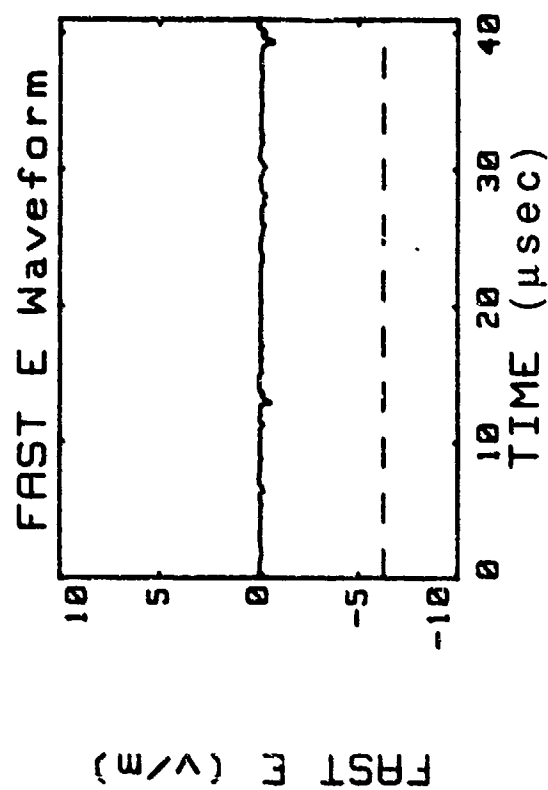
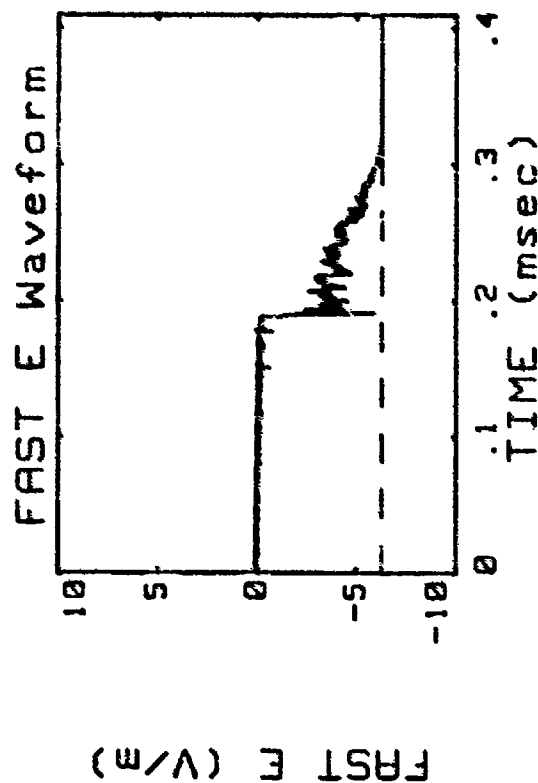


19:23:06.575 8 Aug 1985 (9.5 Km)

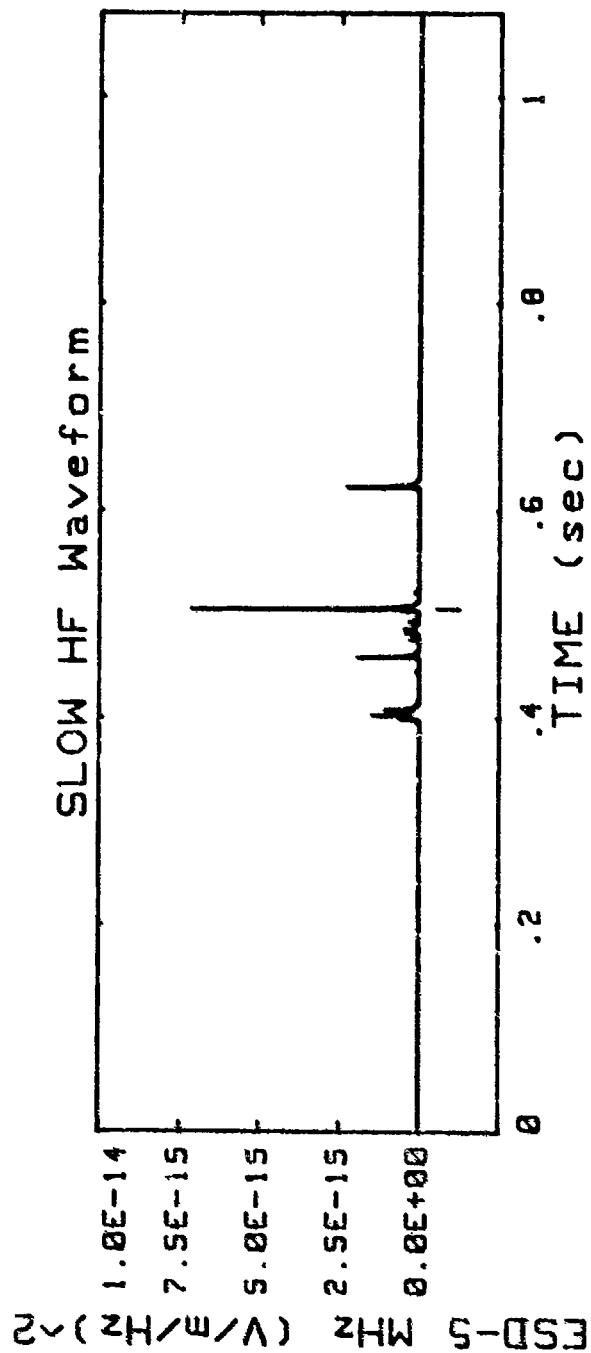
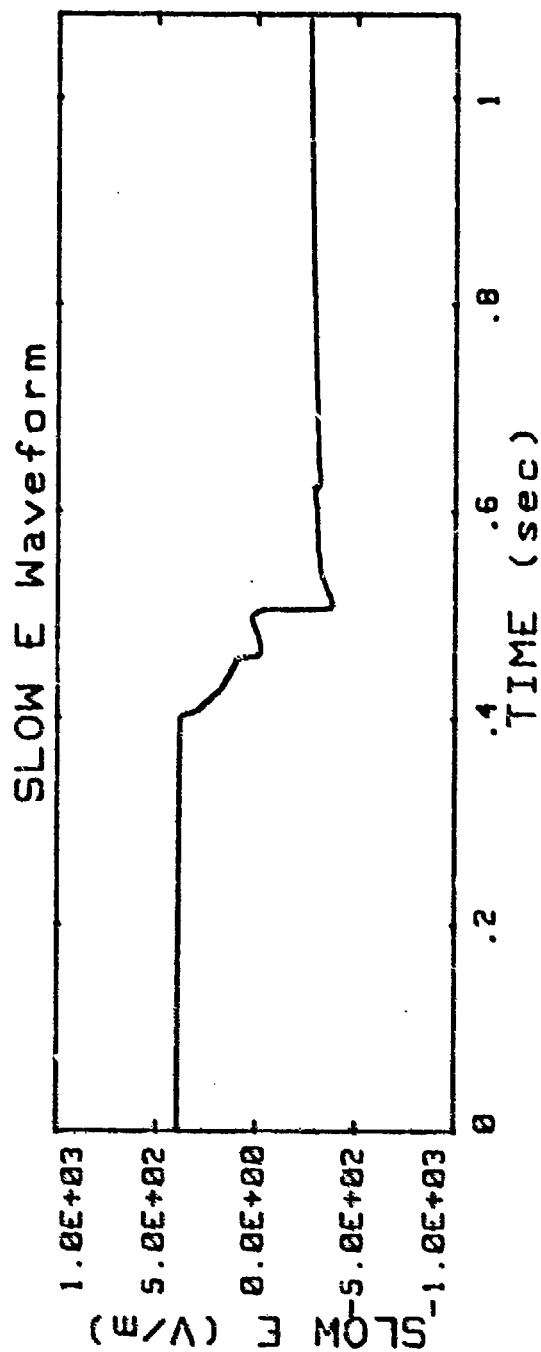


220192635.989 1985

Stepped Leader (9.1 Km)

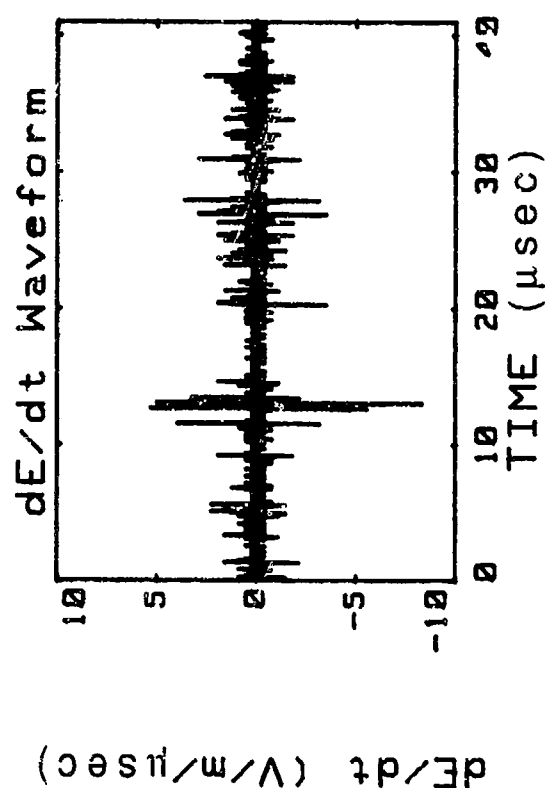
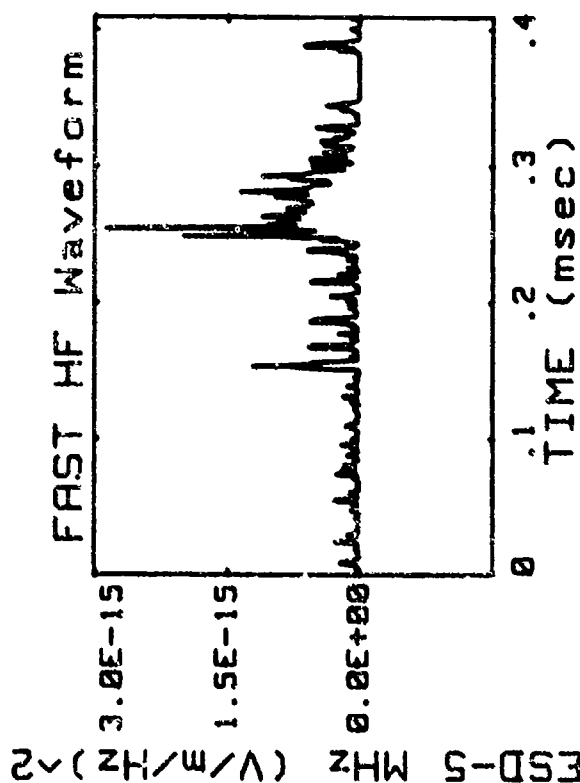
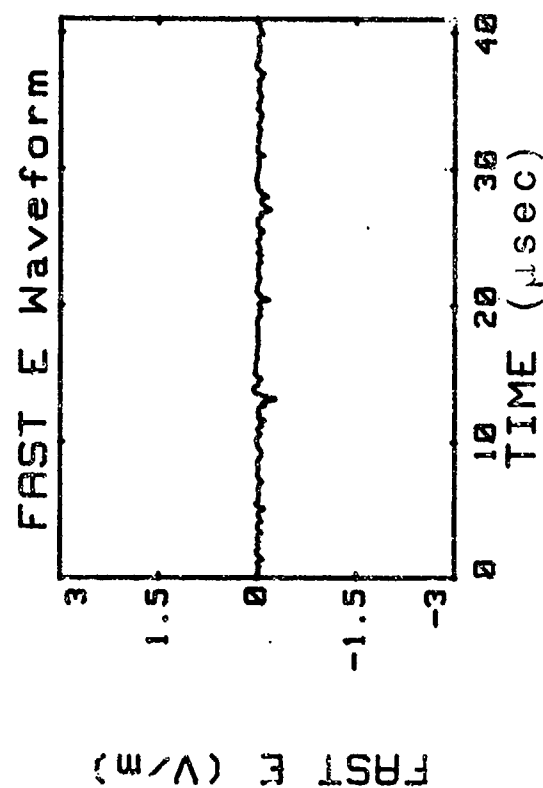
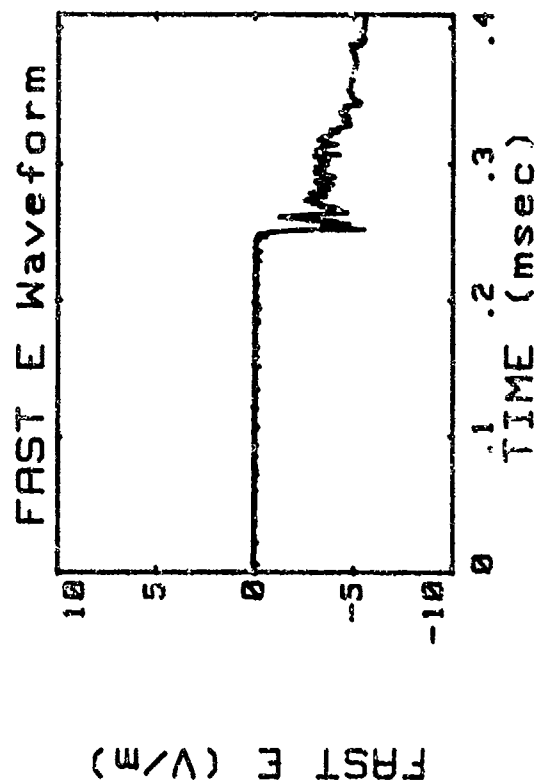


19:26:35.496 8 Aug 1985 (9.1 Km)

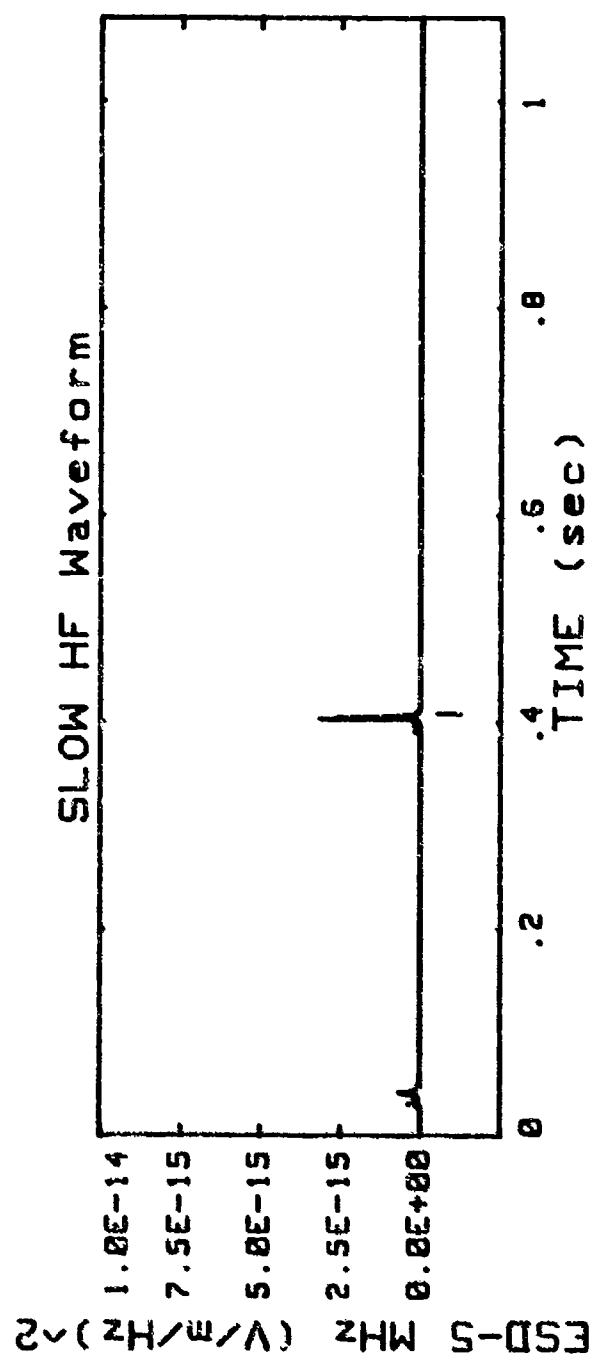
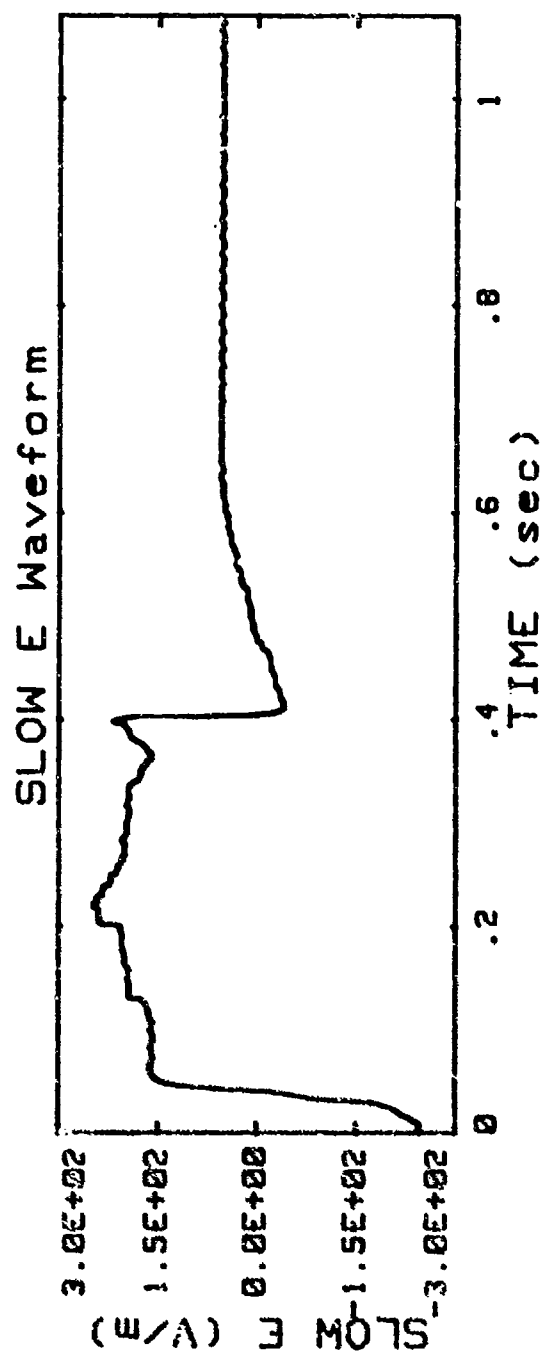


220192014.572 1985

Stepped Leader (8.3 Km)

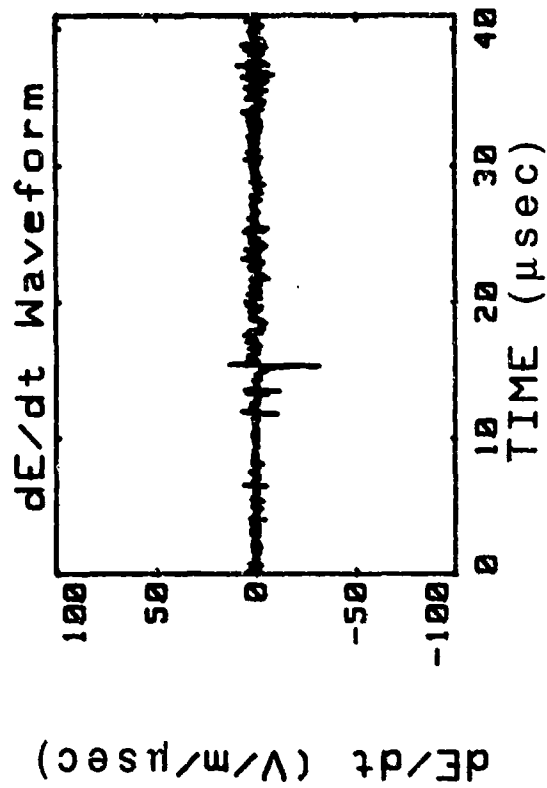
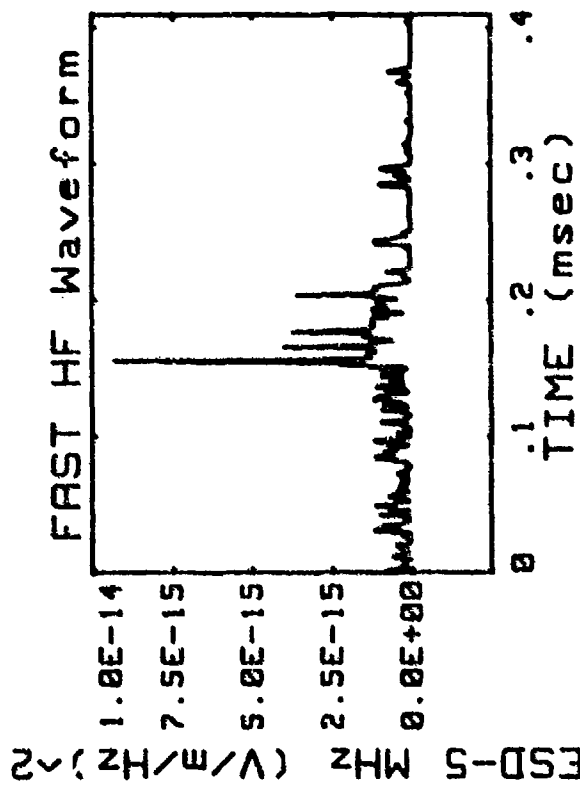
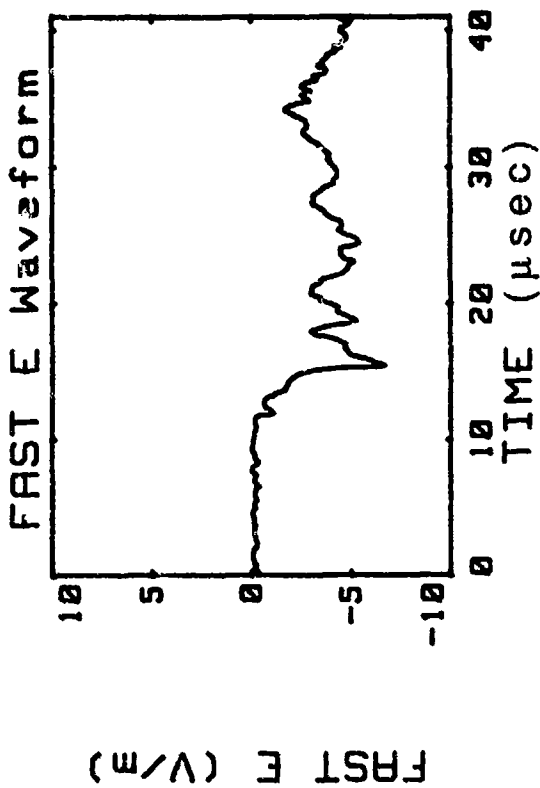
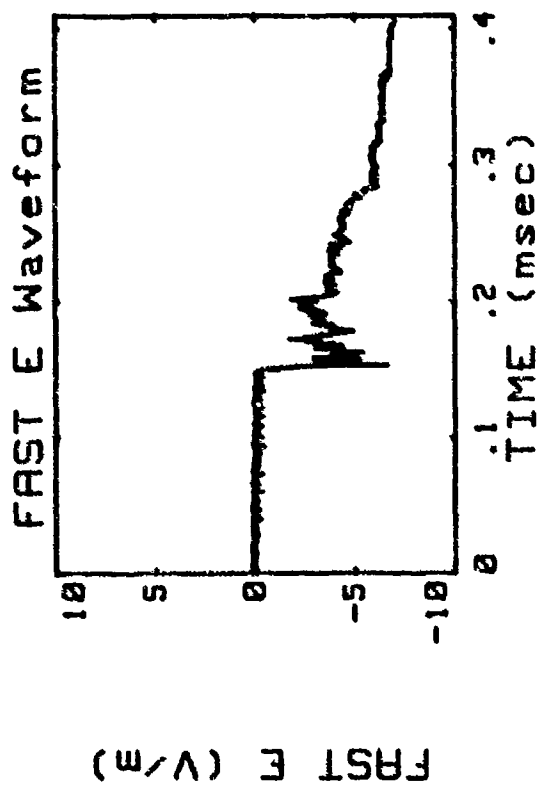


19:28:13.976 8 Aug 1985 (8.3 Km)

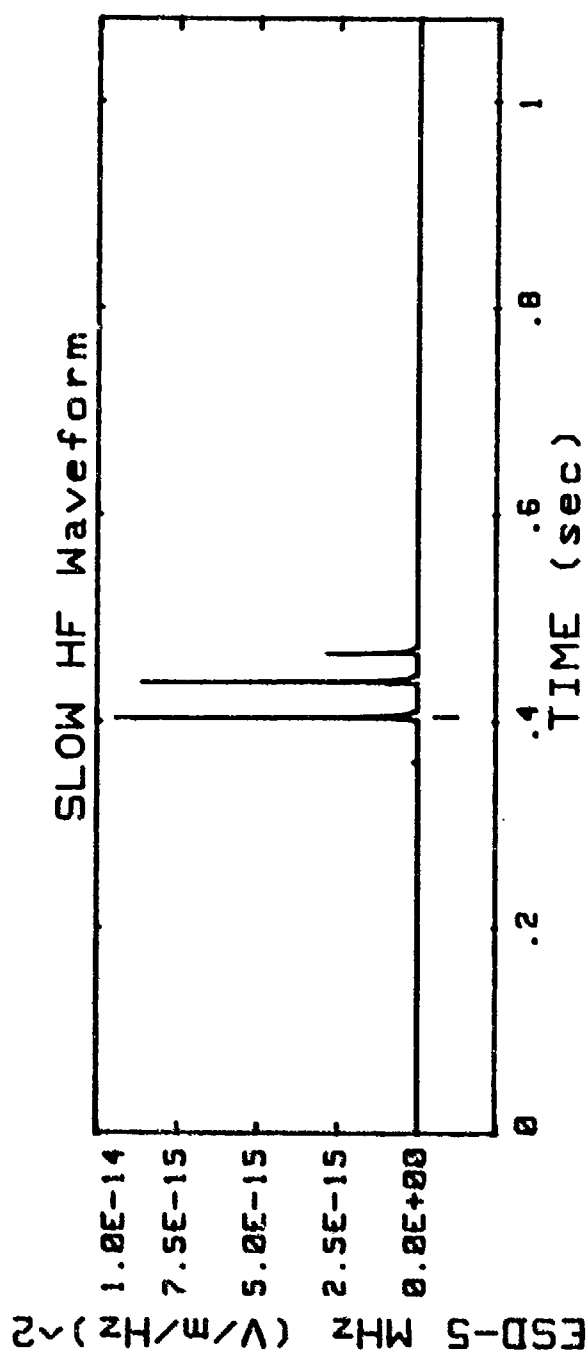
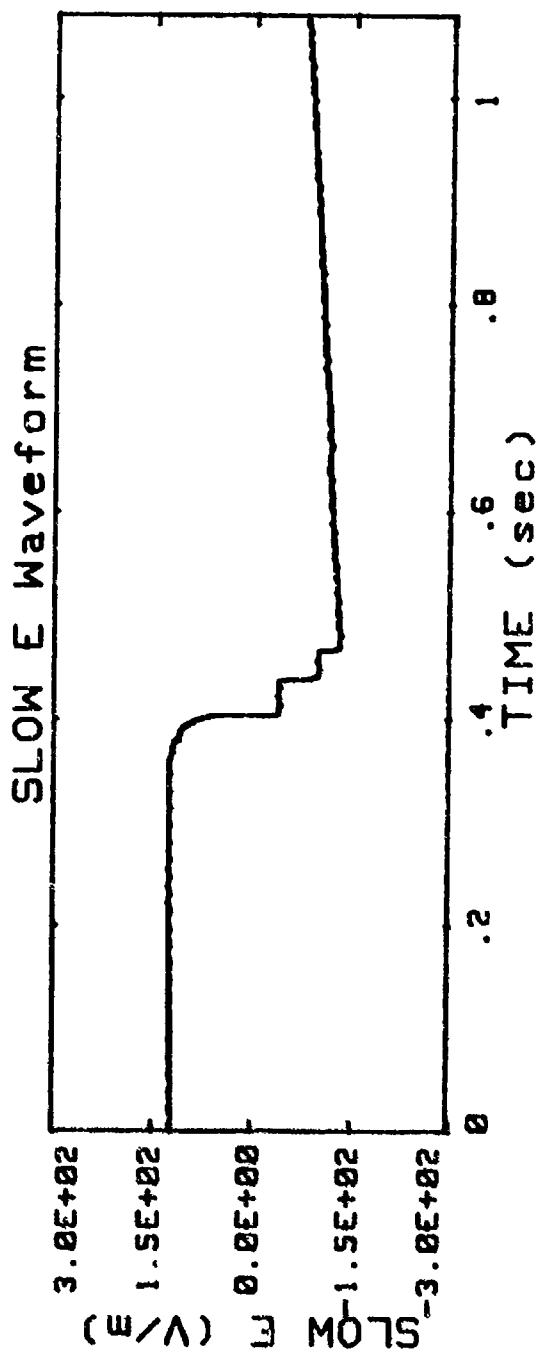


220192837.212 1985

1st RS (11.9 Km)

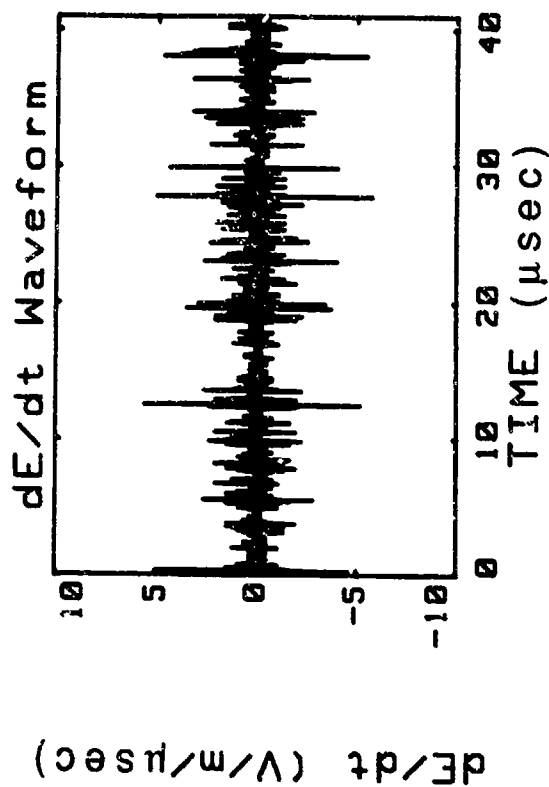
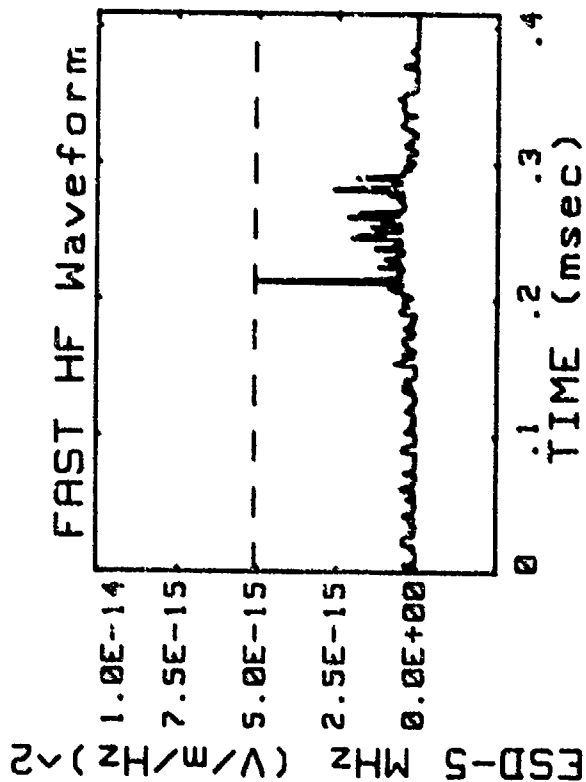
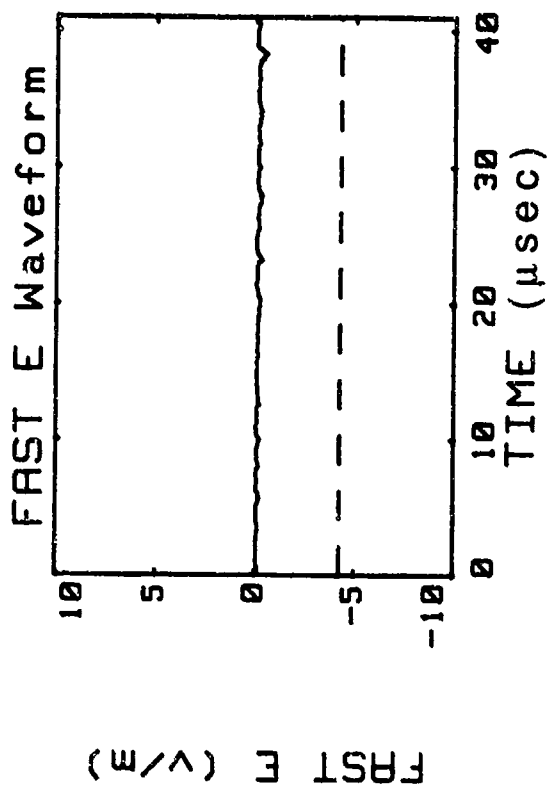
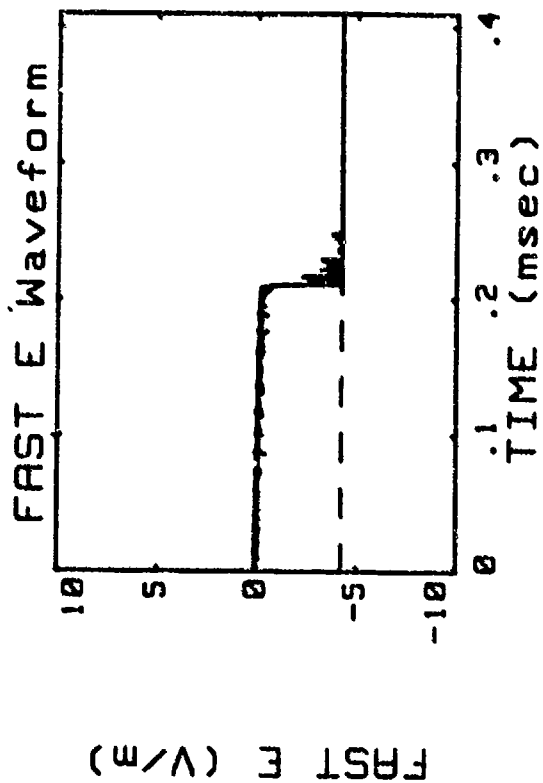


19:28:36.820 8 Aug 1985 (11.9 Km)

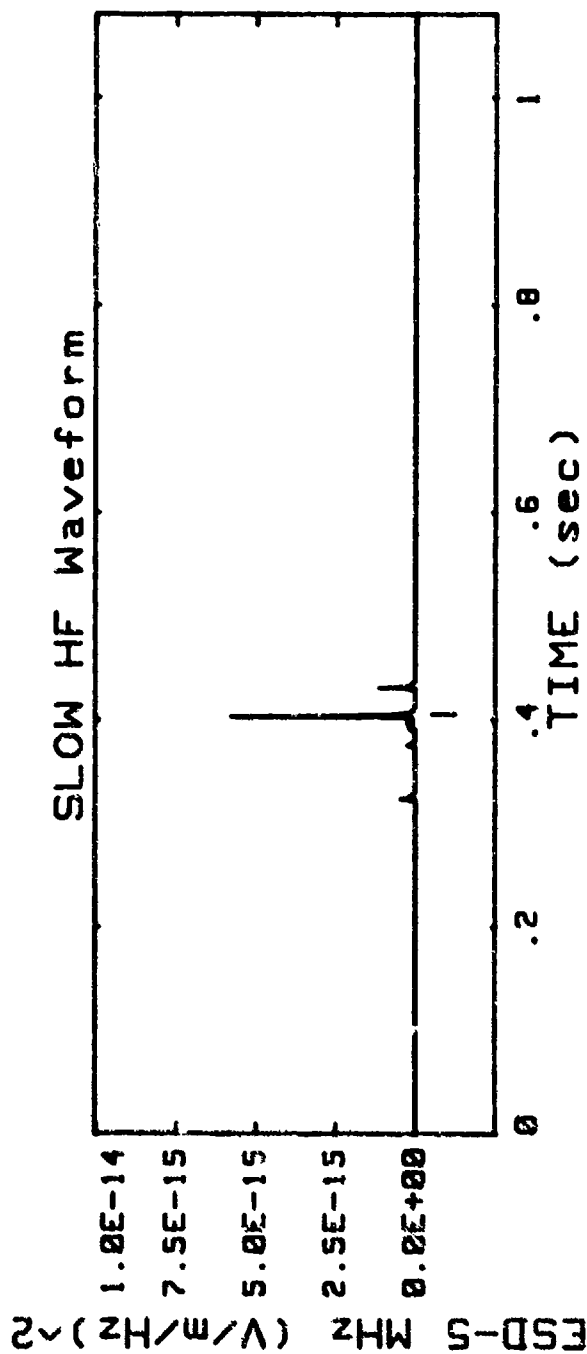
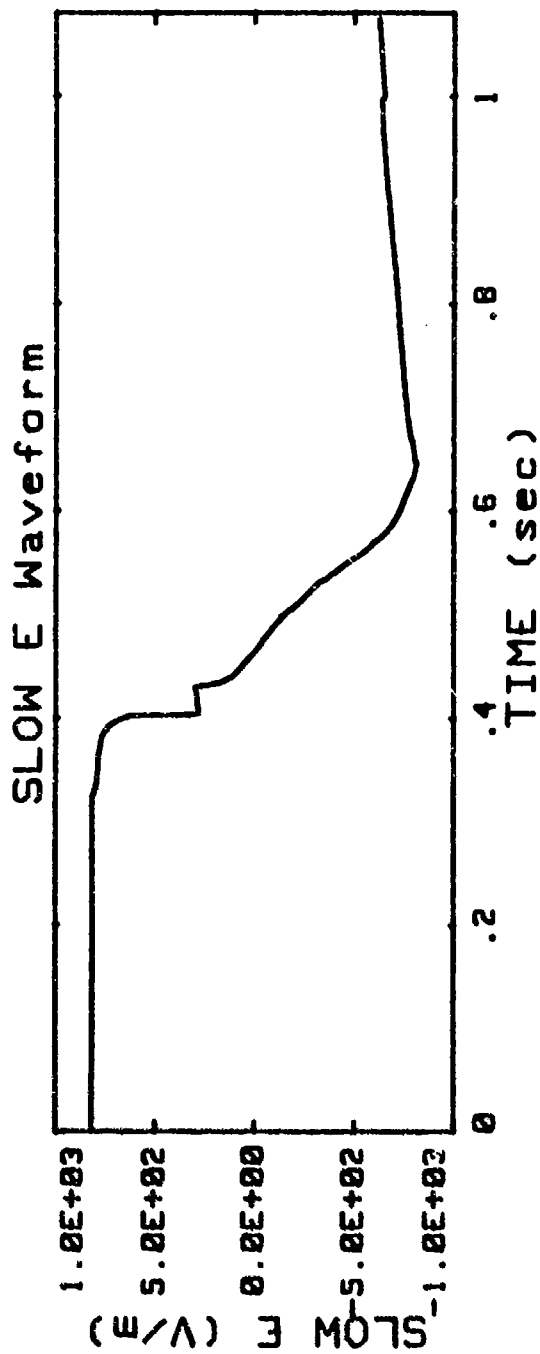


220192845.624 1985

Stepped Leader (7.1 Km)

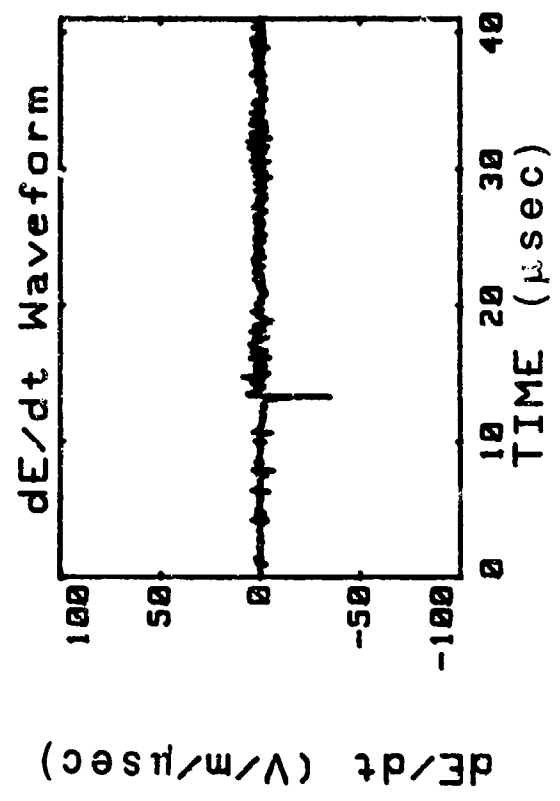
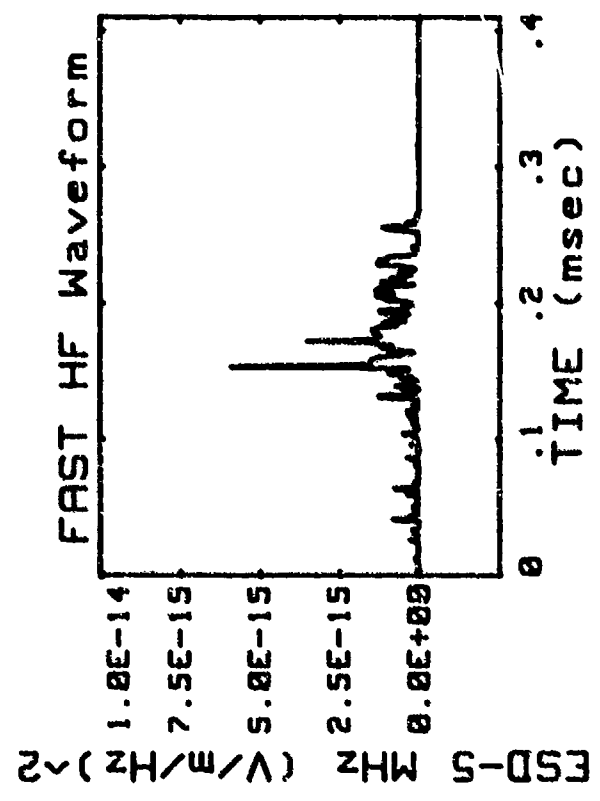
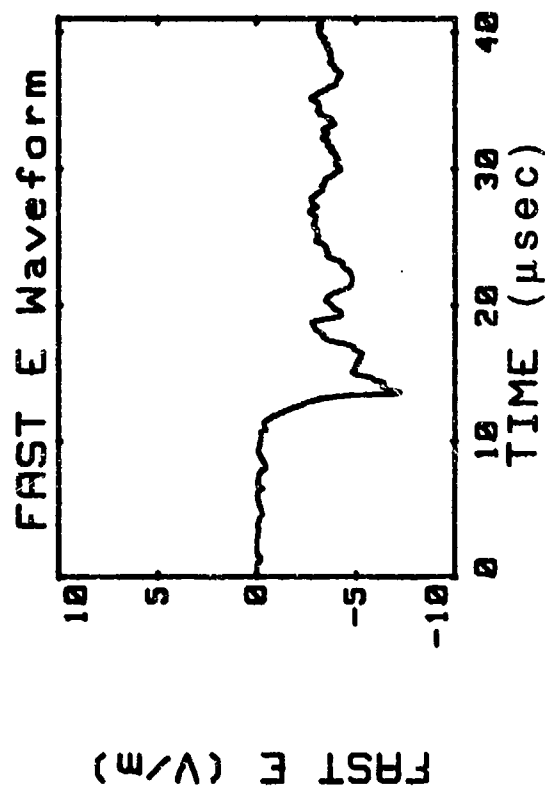
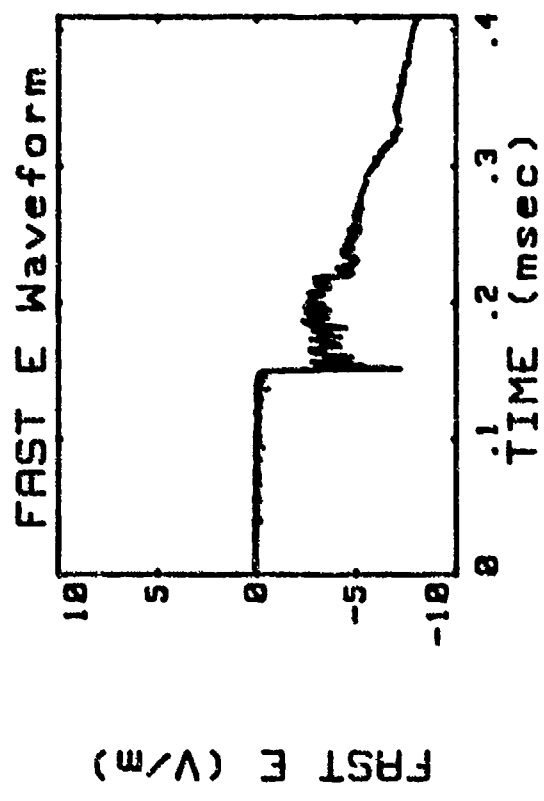


19:28:45.231 8 Aug 1985 (7.1 Km)

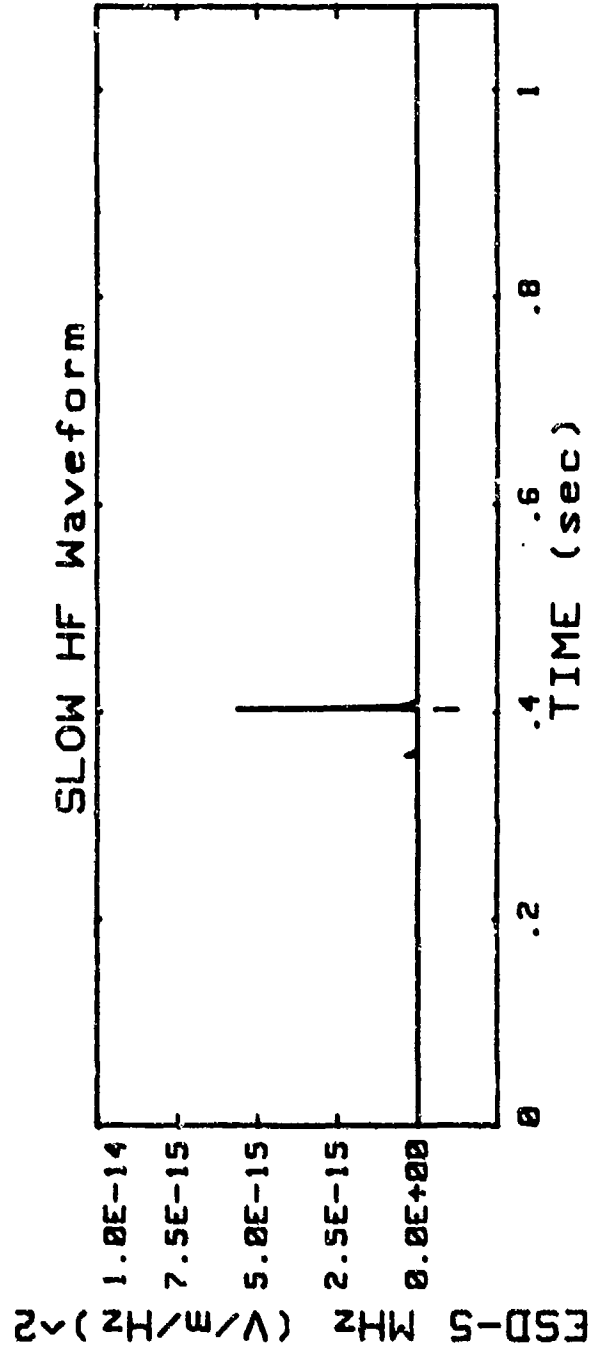
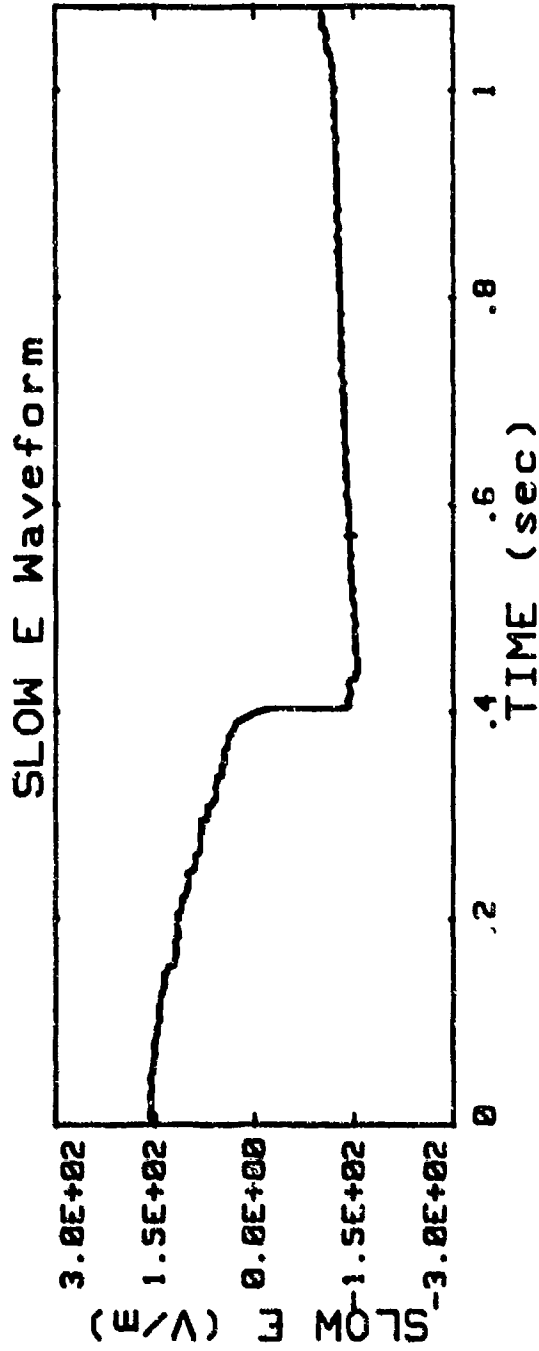


220192906.139 1985

1st RS (12.5 Km)

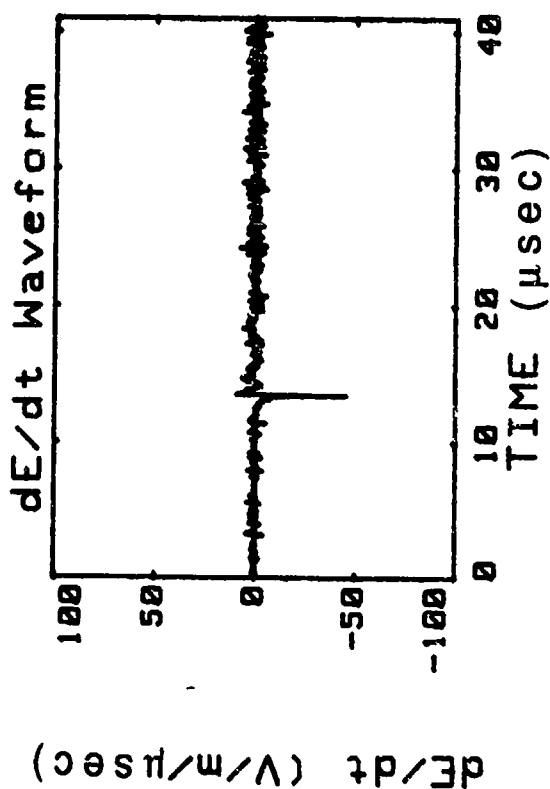
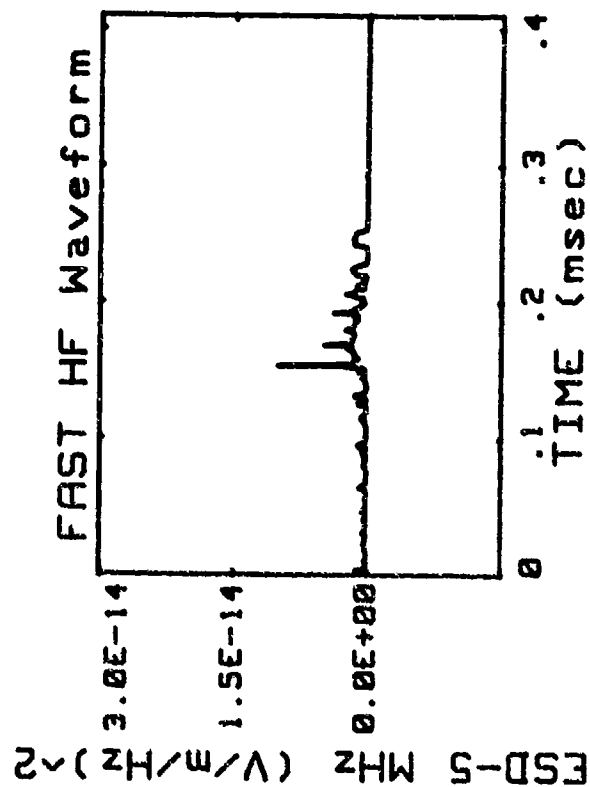
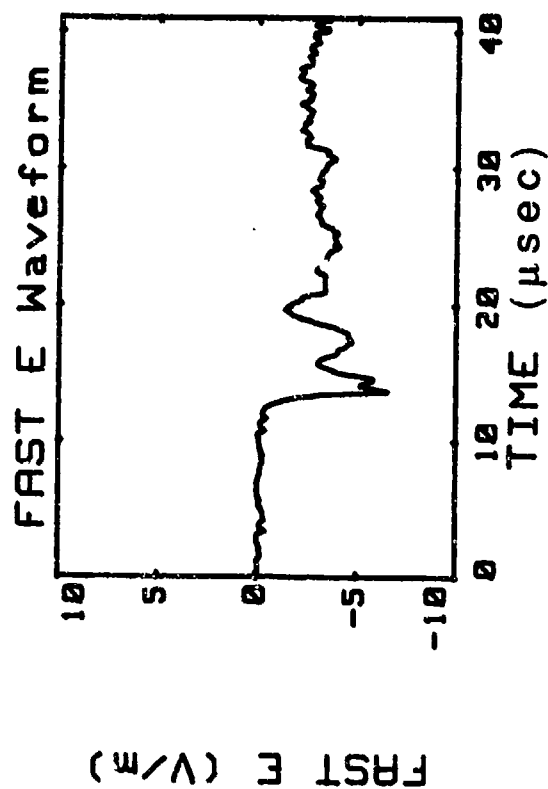
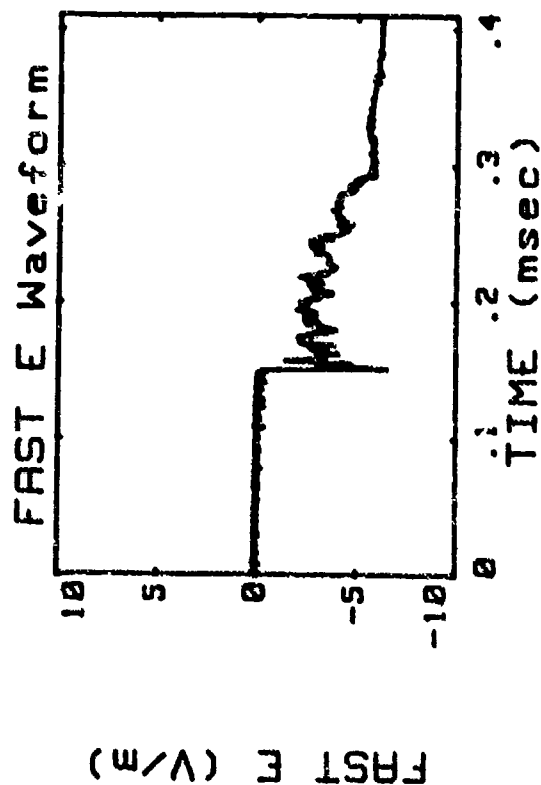


19:29:05.749 8 Aug 1985 (12.5 Km)



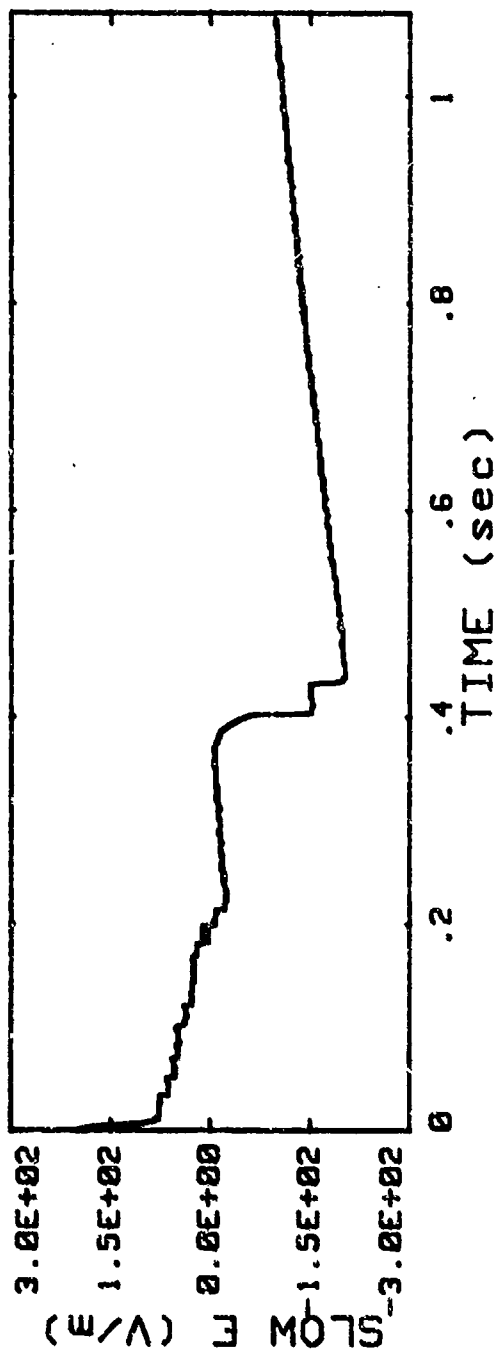
220193004.975 1985

1st RS (13.3 Km)

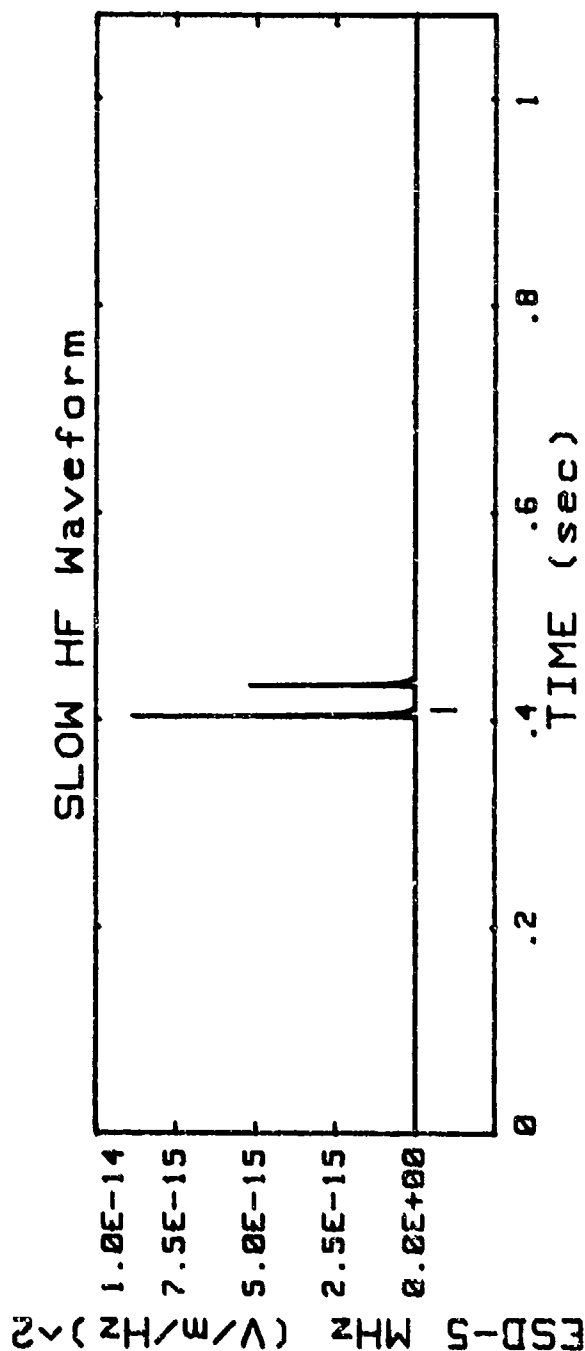


19:30:04.578 8 Aug 1985 (13.3 Km)

SLOW E waveform

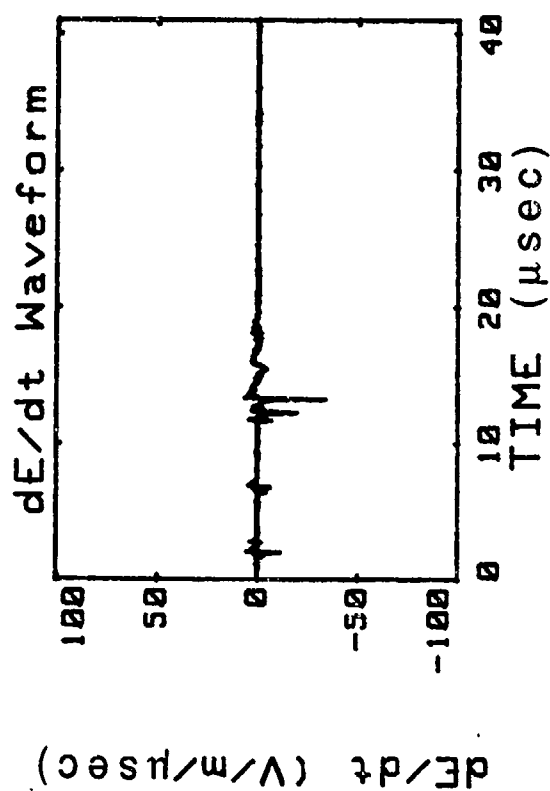
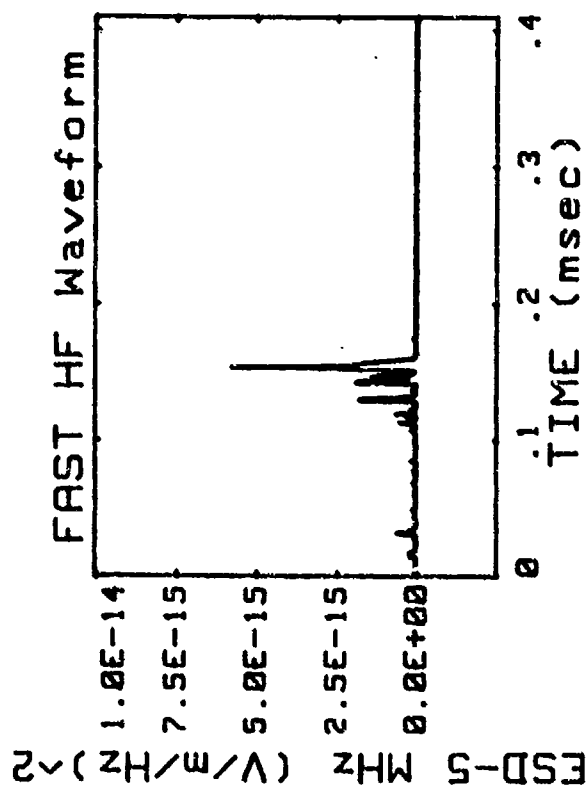
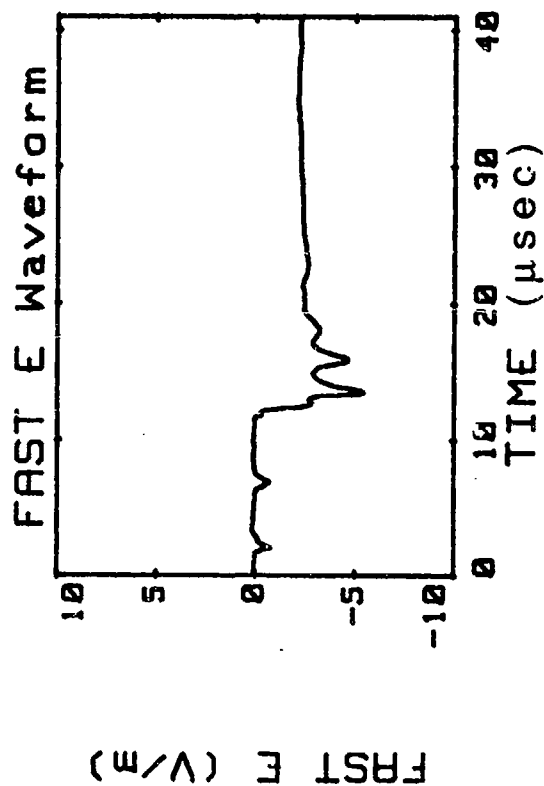
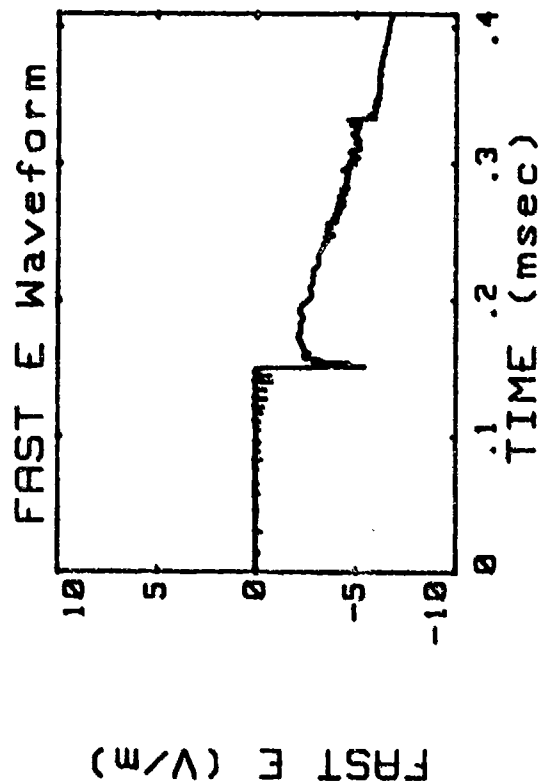


SLOW HF waveform



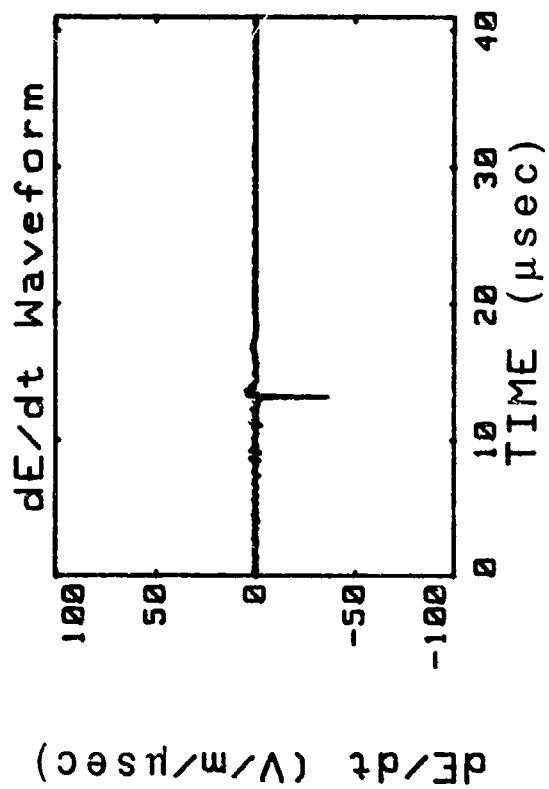
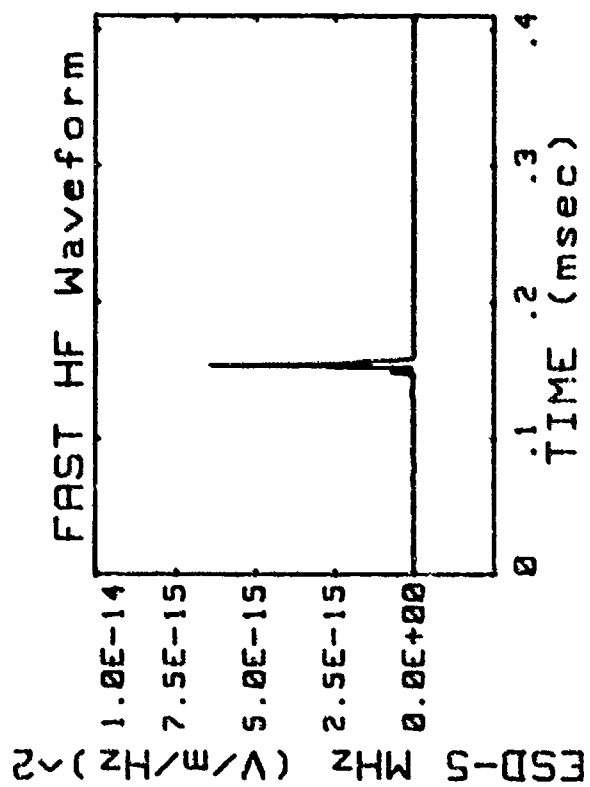
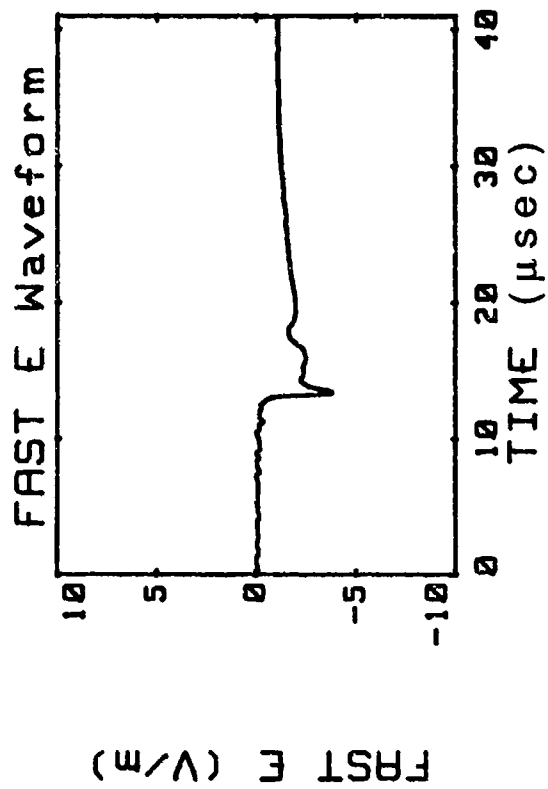
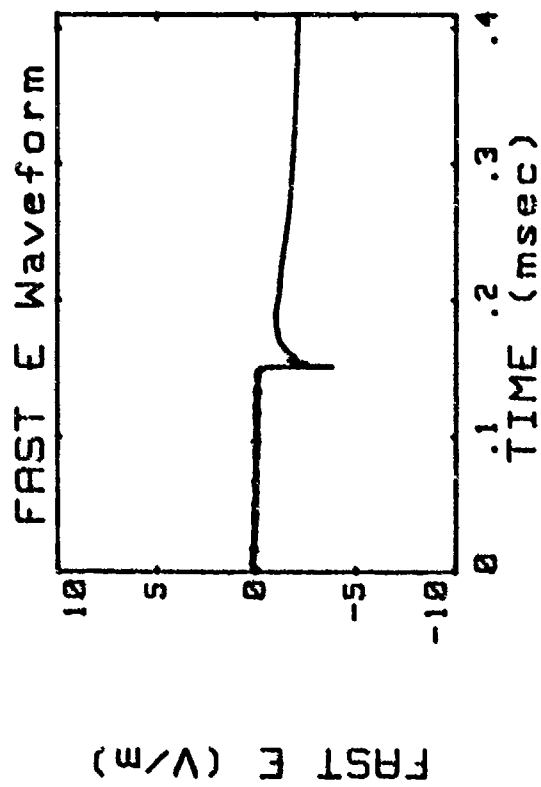
220193013.676 1985

DS Subs RS (14.7 Km)

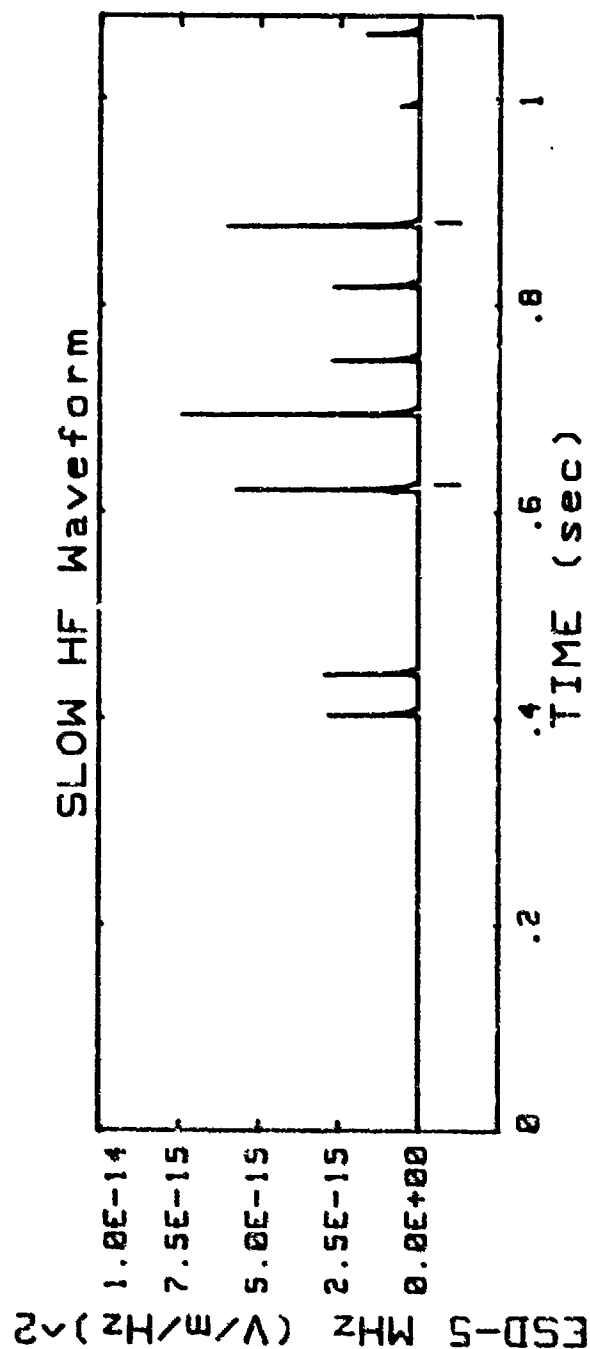
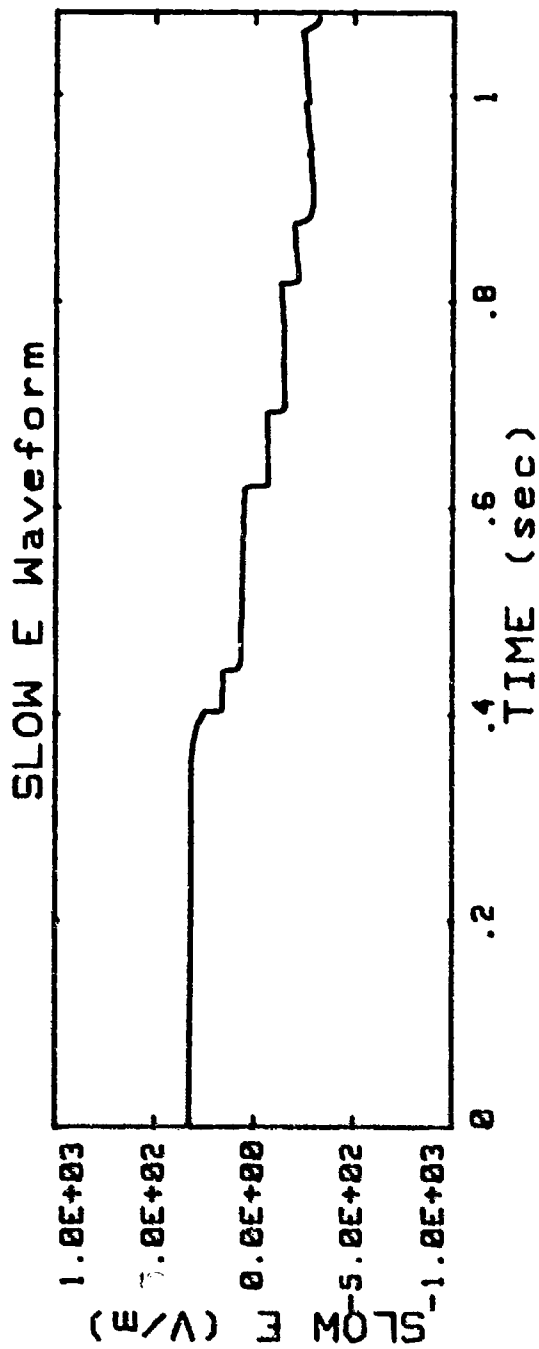


220193013.930 1985

Norm Subs RS (14.7 Km)

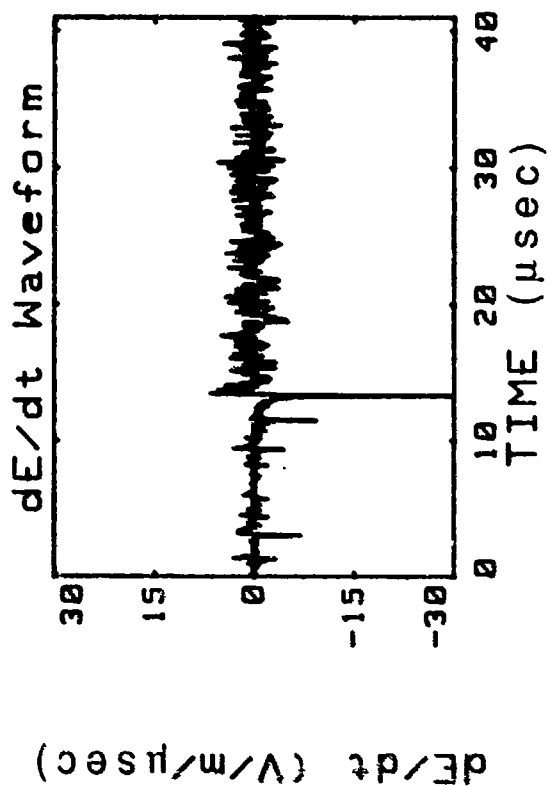
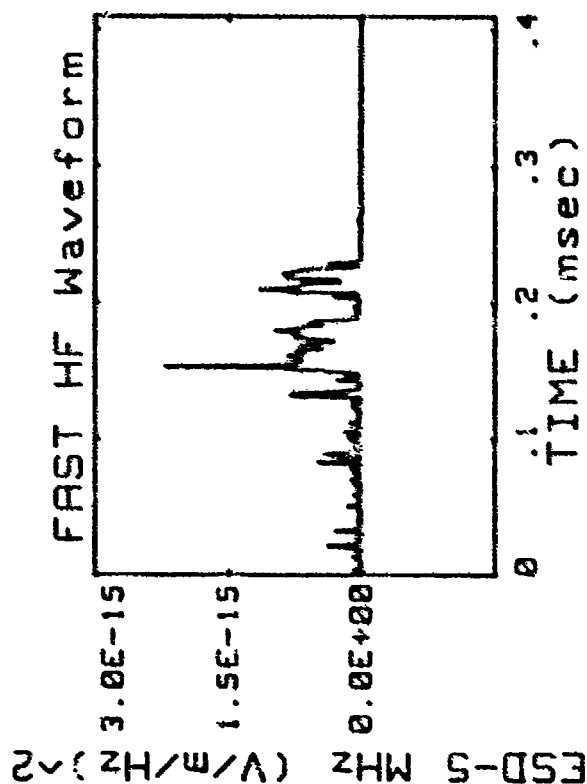
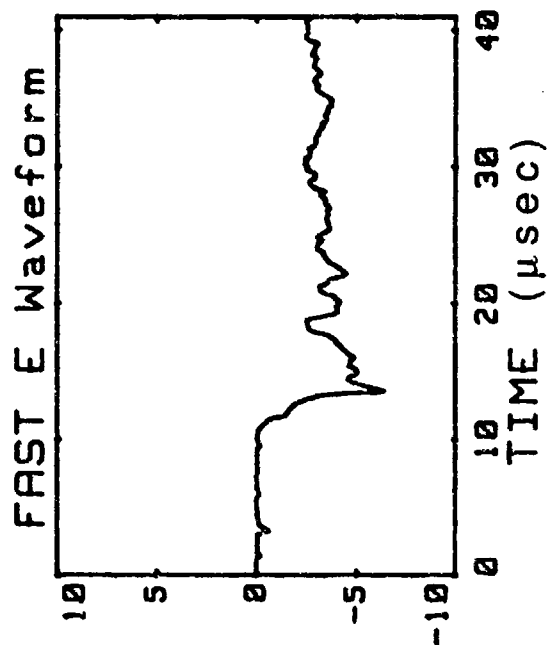
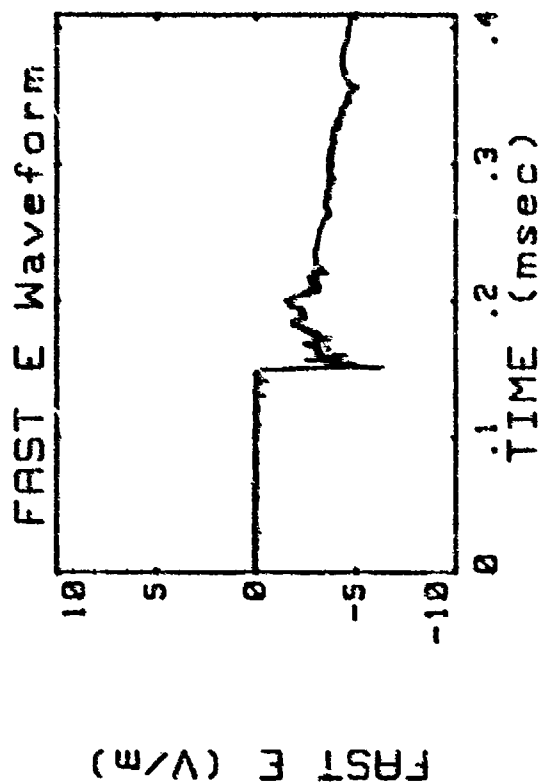


19:30:13.062 8 Aug 1985 (14.7 Km)

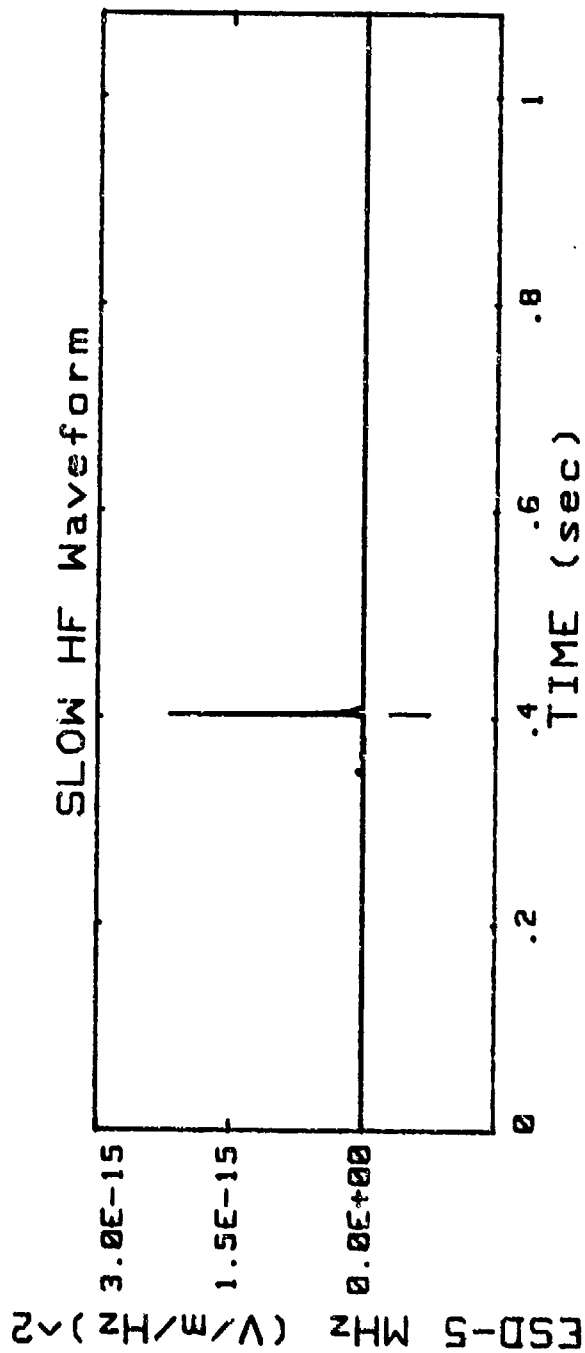
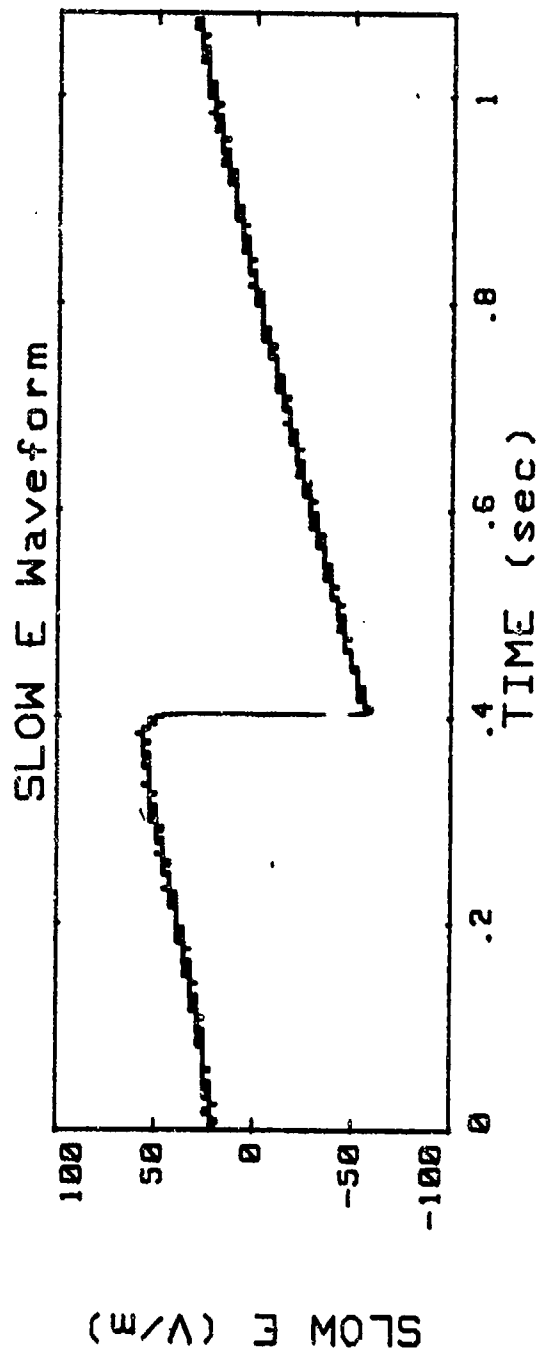


220193032.039 1985

1st RS (9.2 Km)

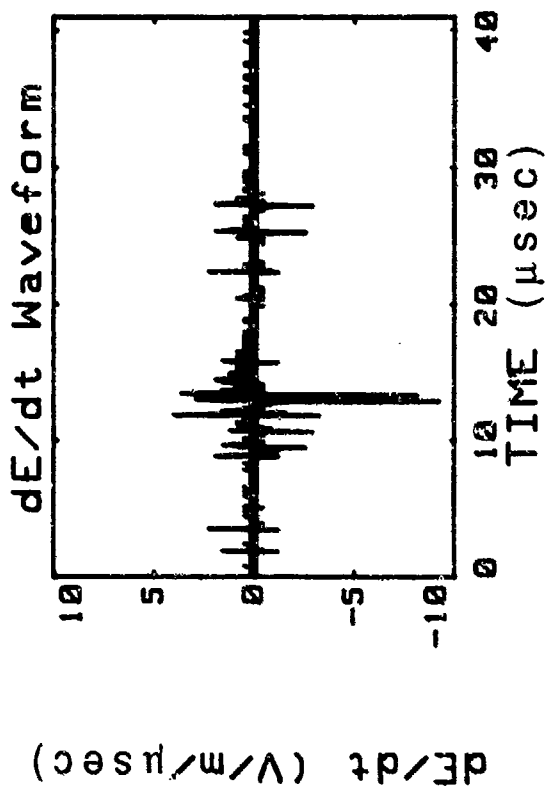
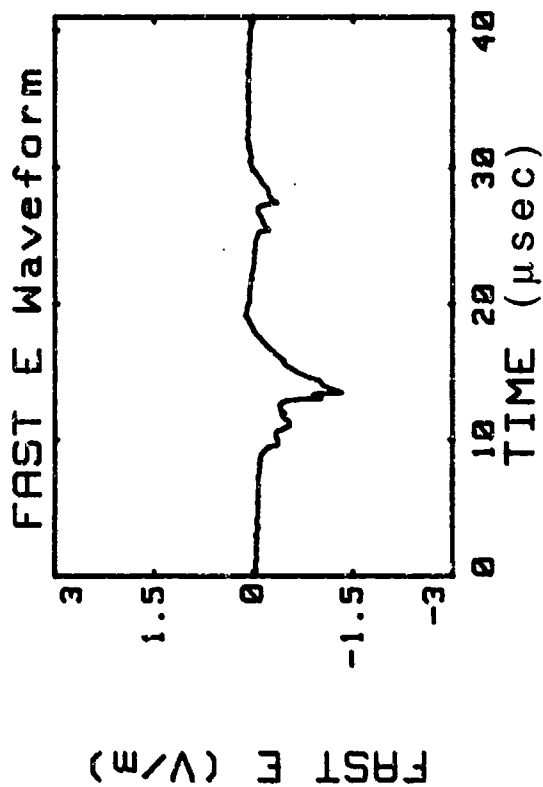
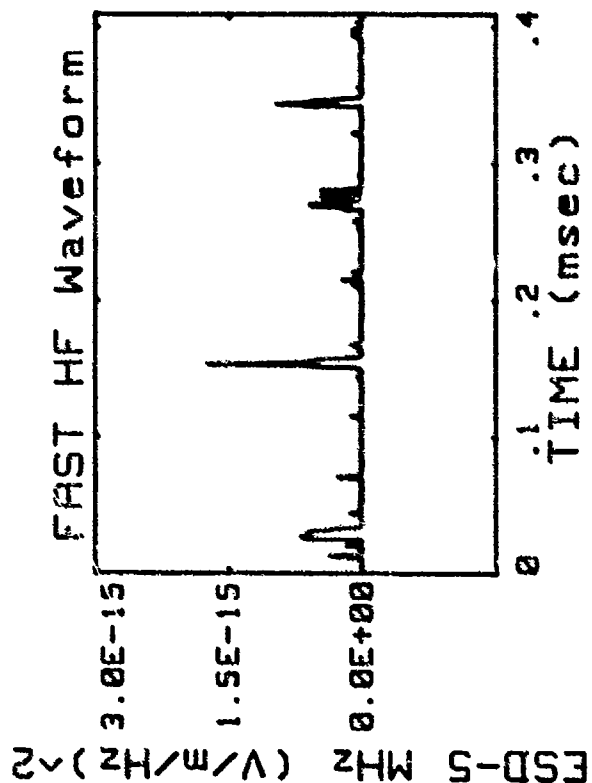
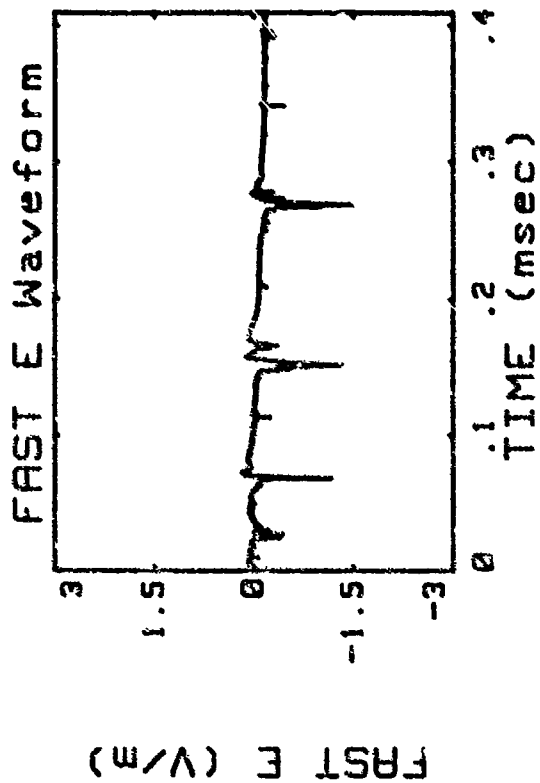


19:30:31.648 8 Aug 1985 (9.2 Km)



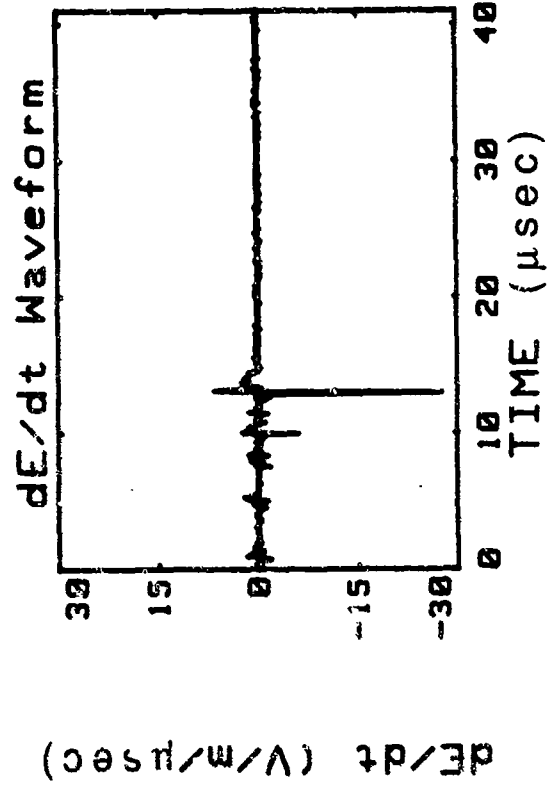
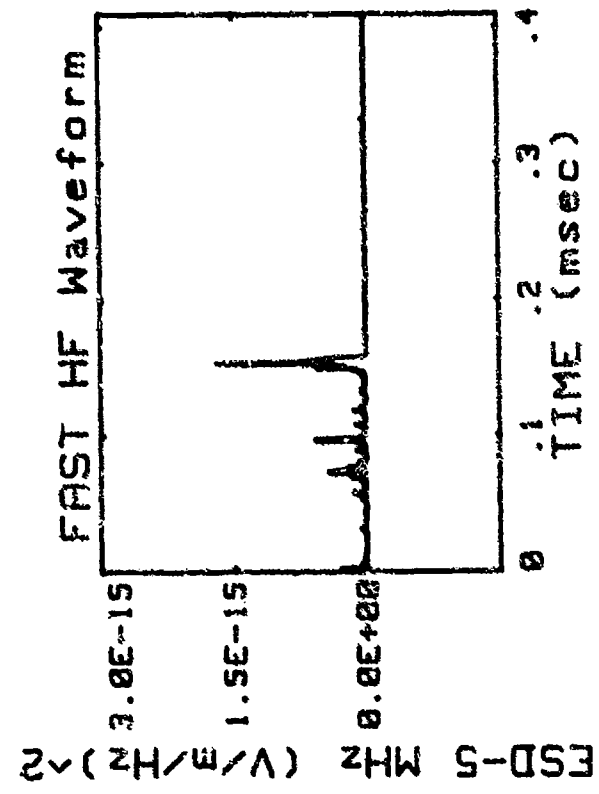
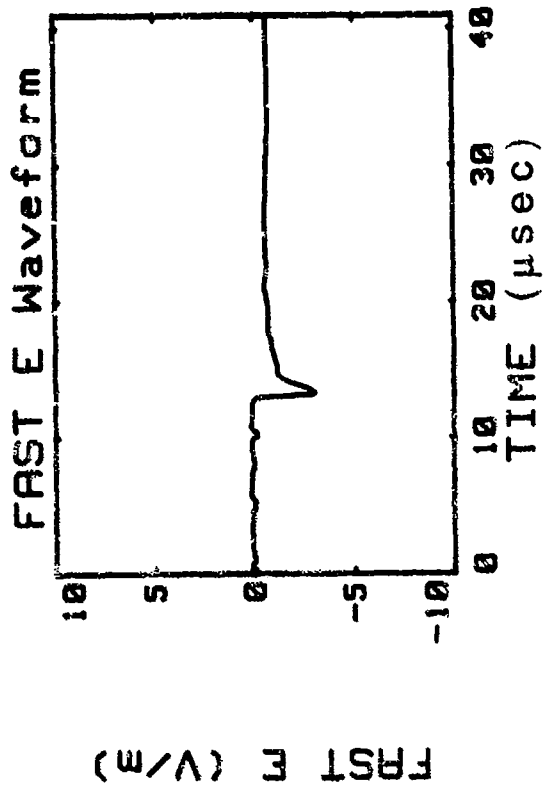
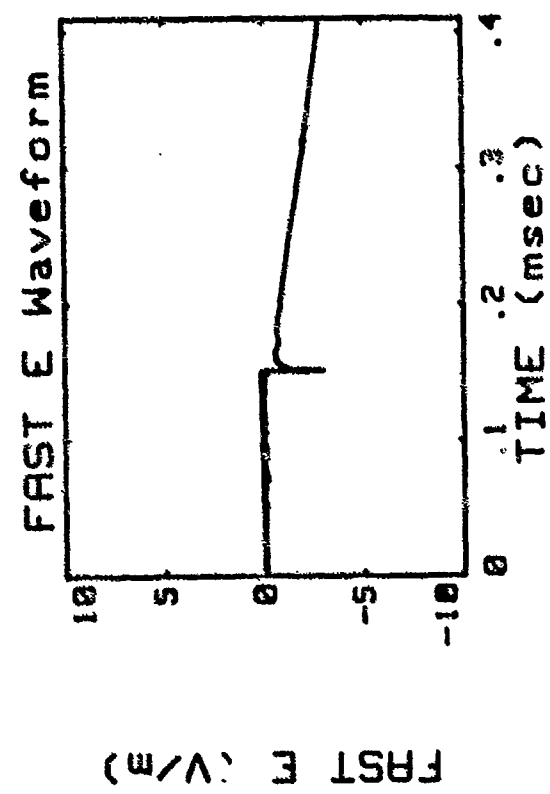
220193042.666 1985

Char Cloud Pulse (8.4 Km)



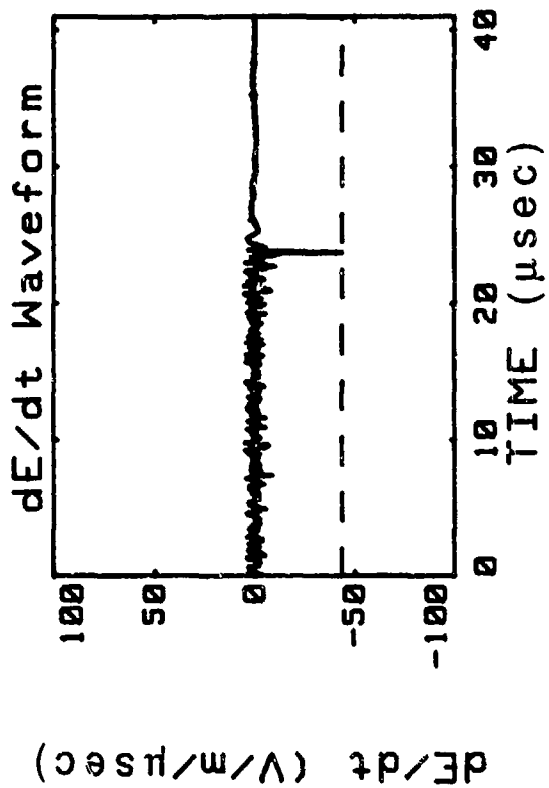
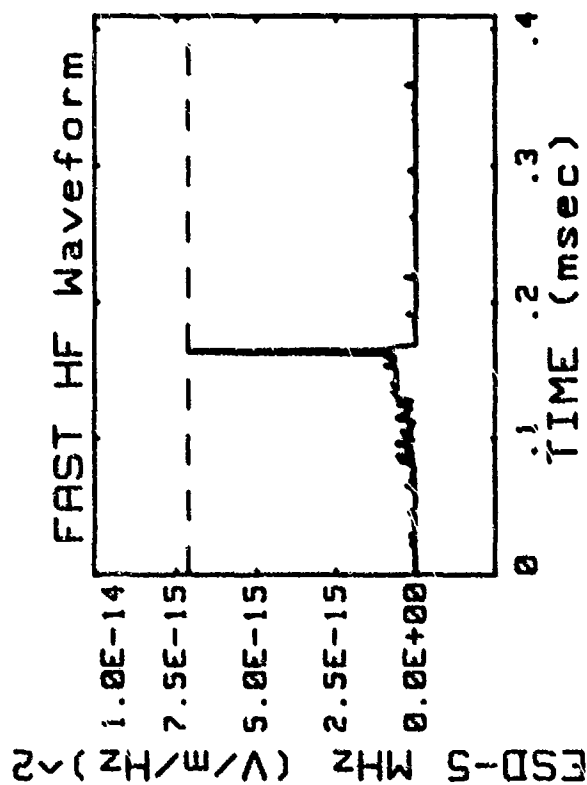
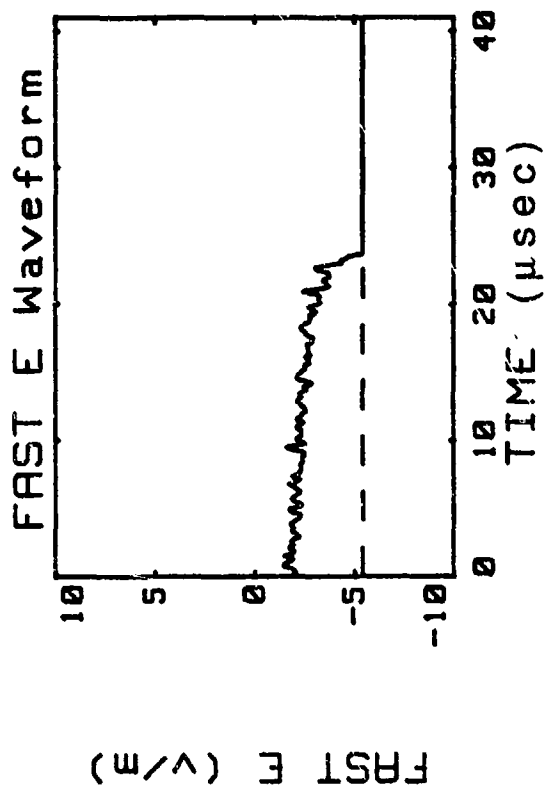
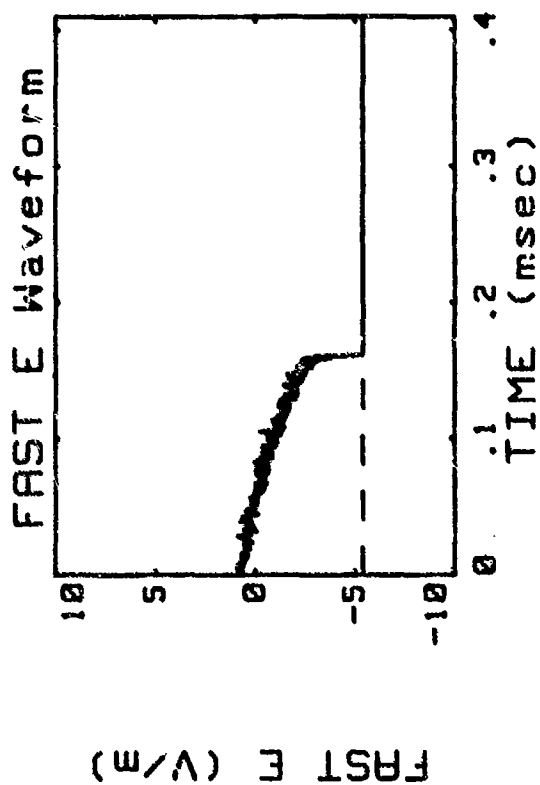
220193042.782 1985

DS Subs RS (8.4 Km)

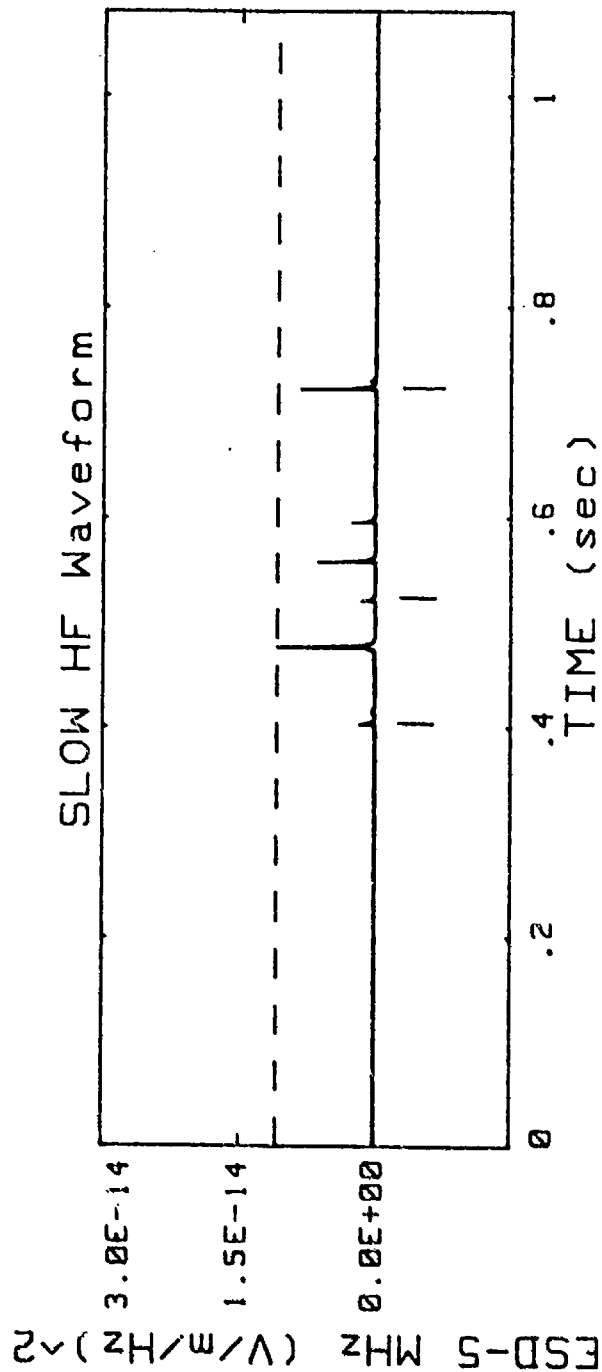
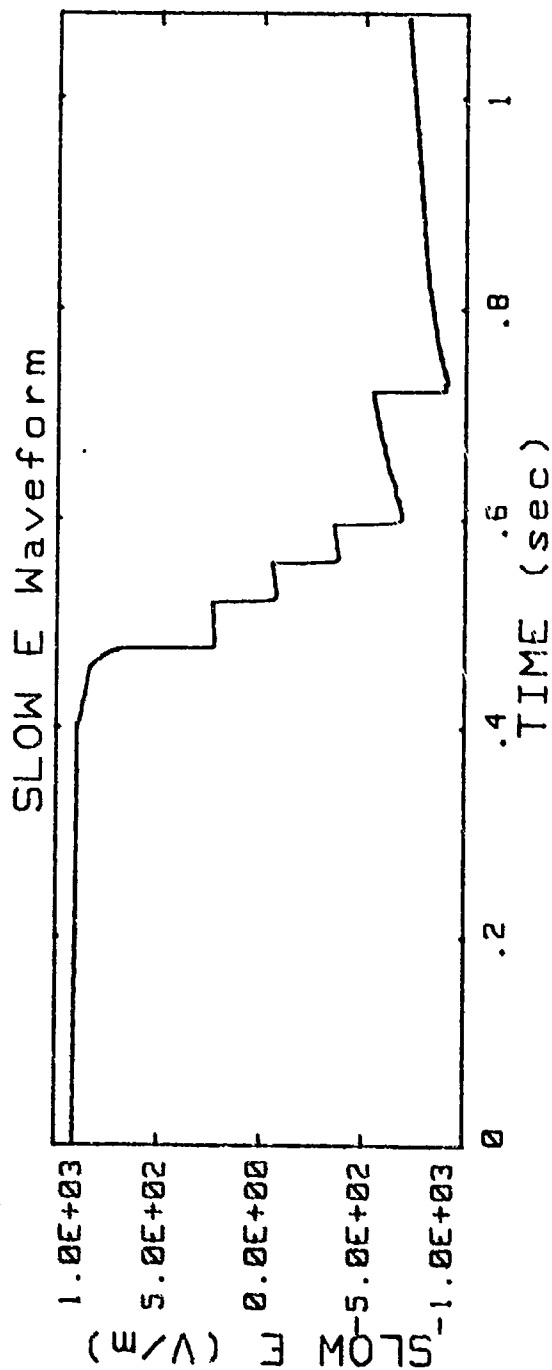


220193042.987 1985

Chaotic Leader (8.4 Km)

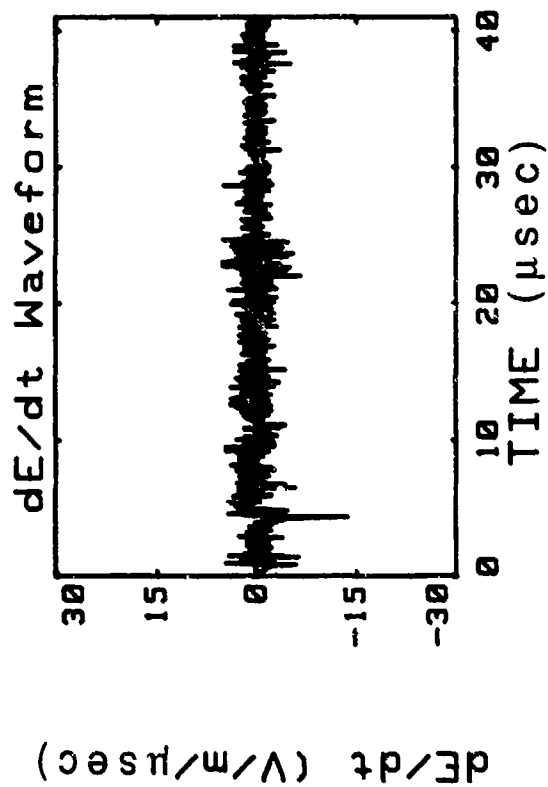
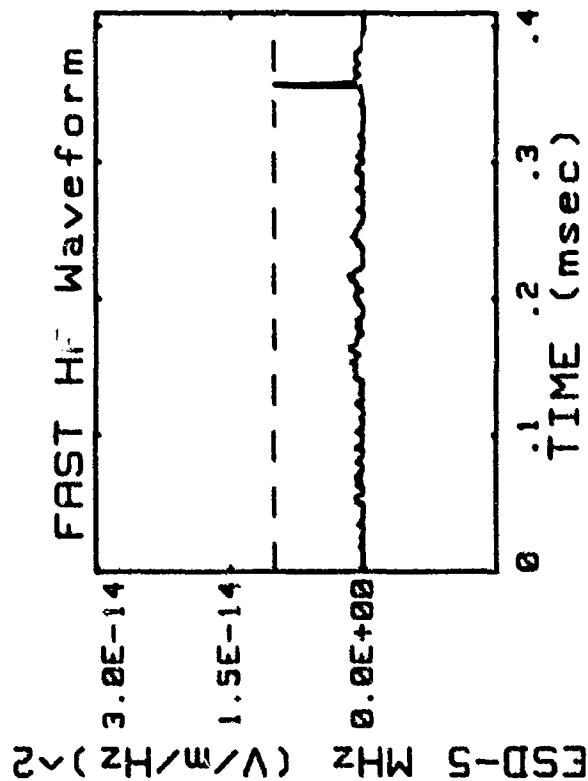
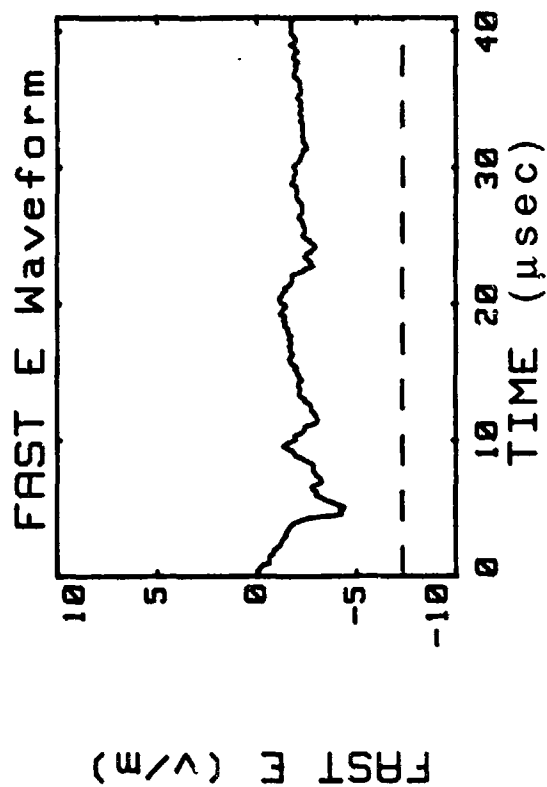
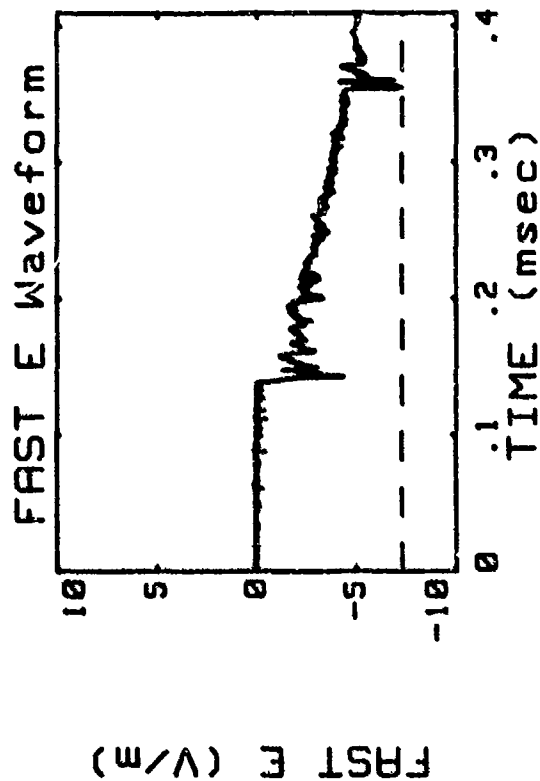


19:30:42.276 8 Aug 1985 (8.4 Km)

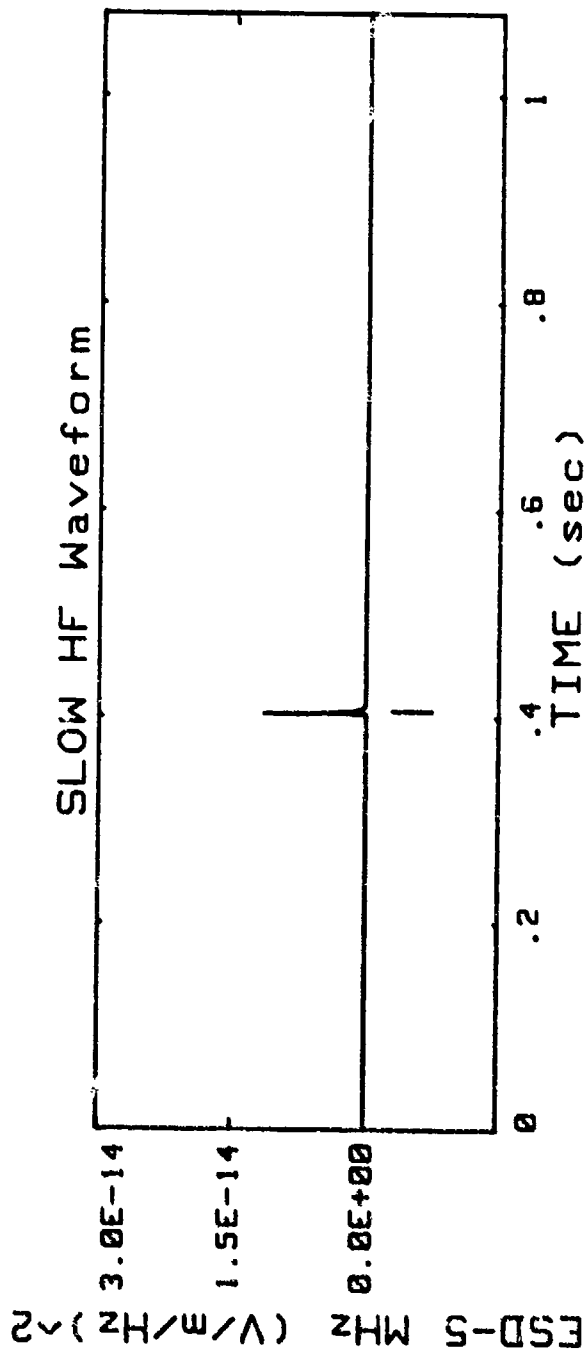
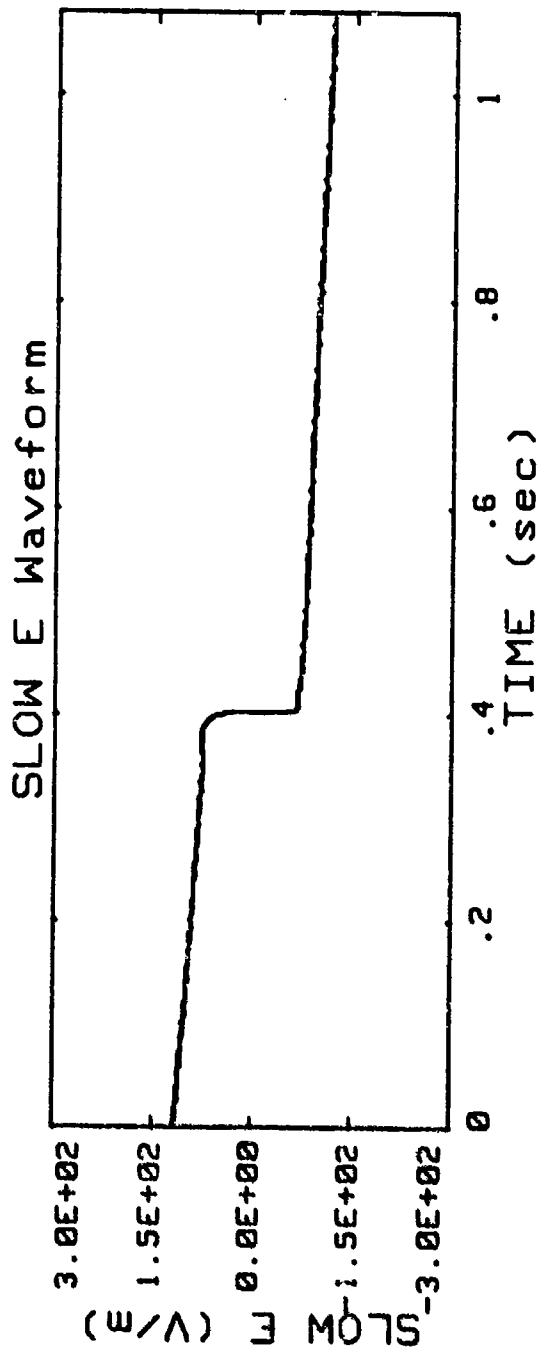


220193058.853 1985

Multiple Gnd RS (10 Km)

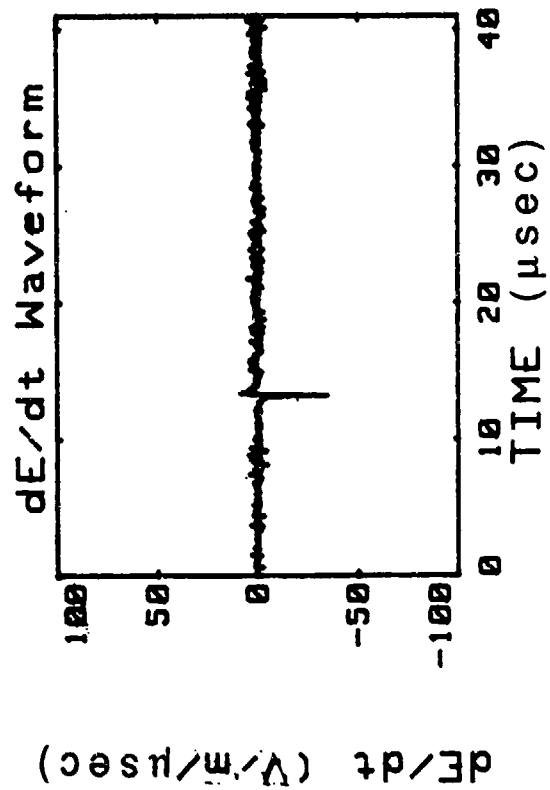
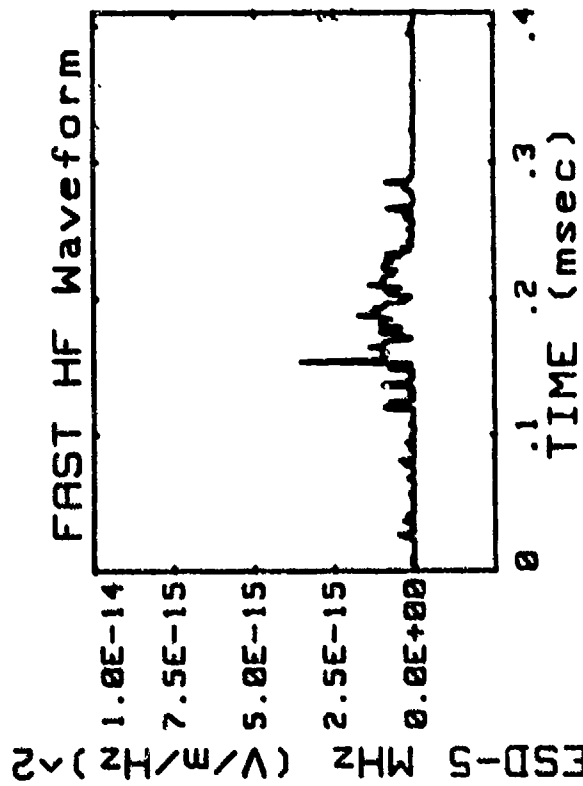
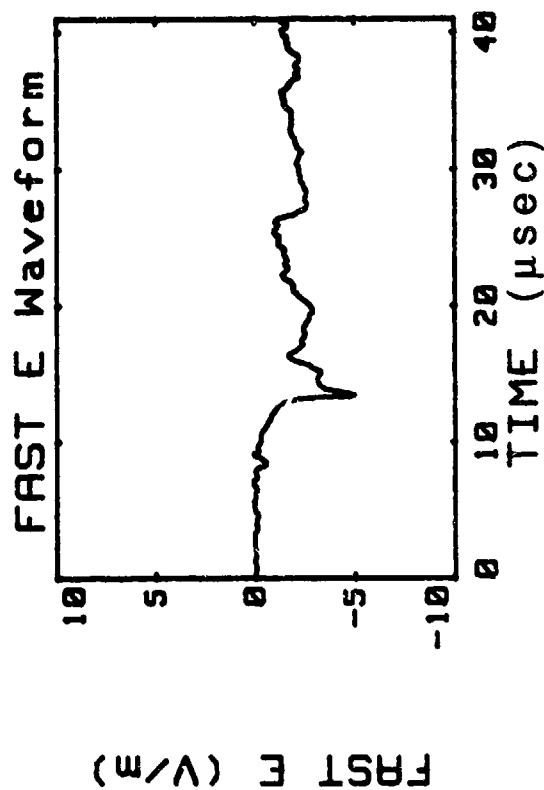
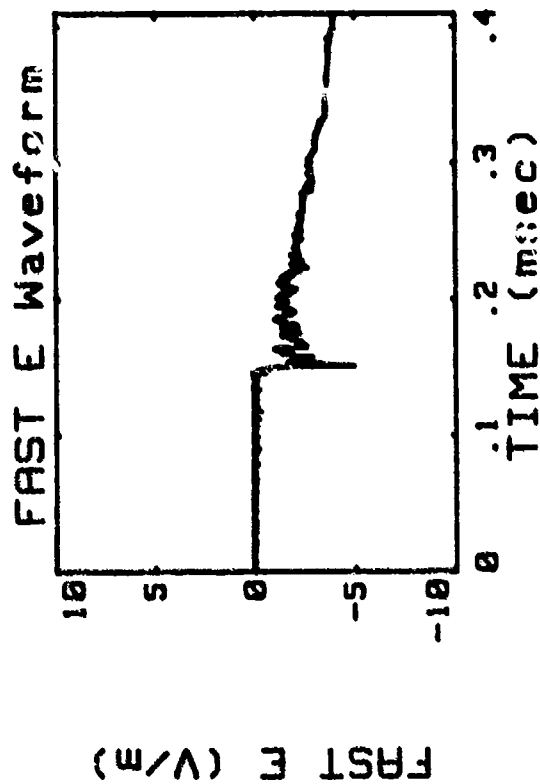


19:30:58.460 8 Aug 1985 (10 Km)



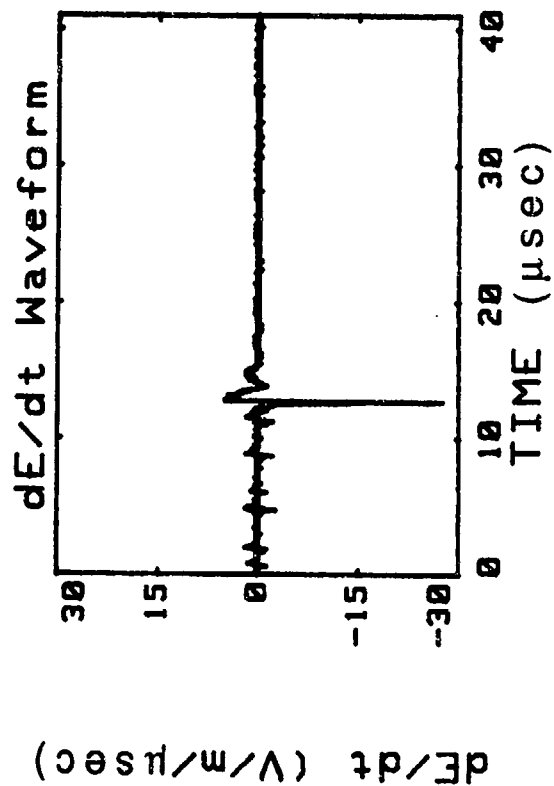
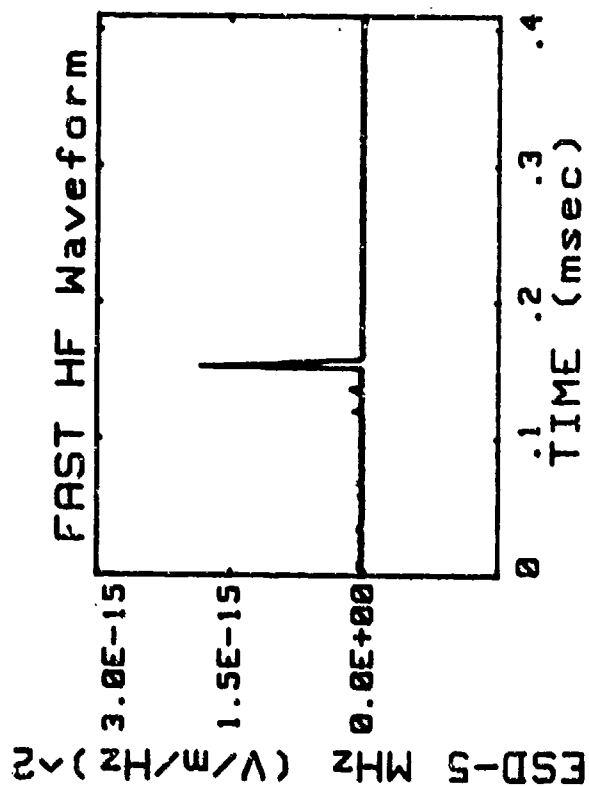
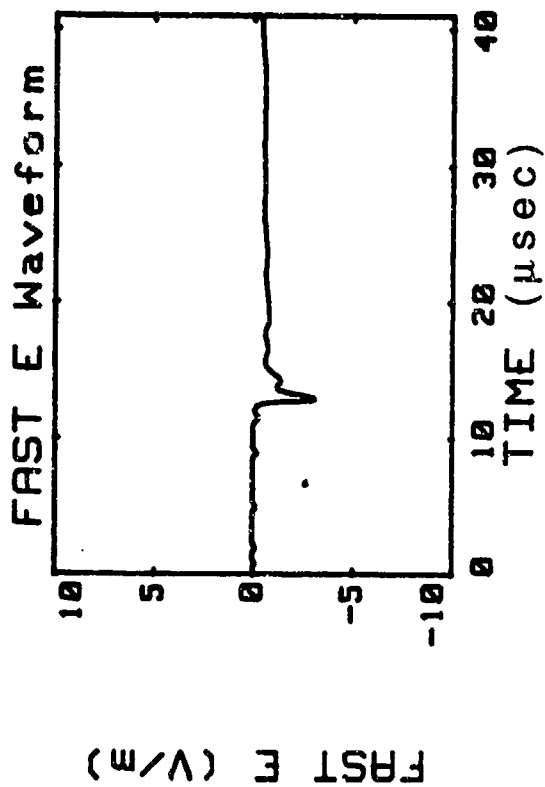
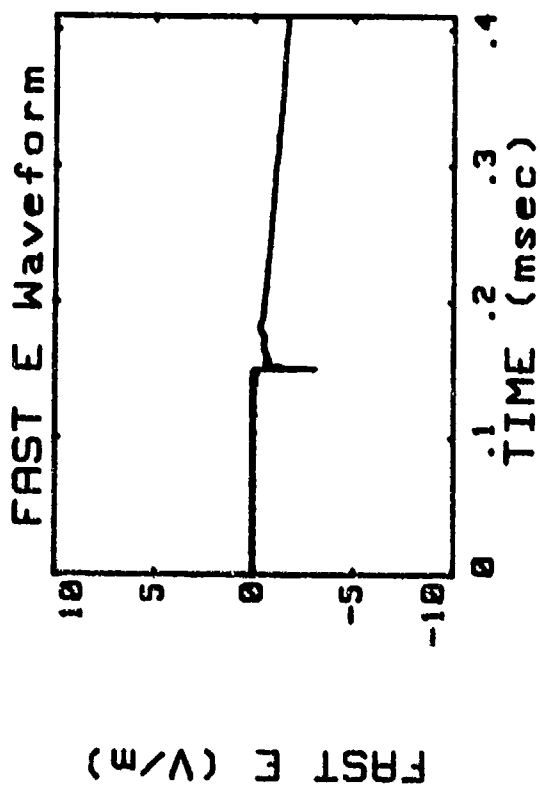
220193202.826 1985

1st RS (10.5 Km)

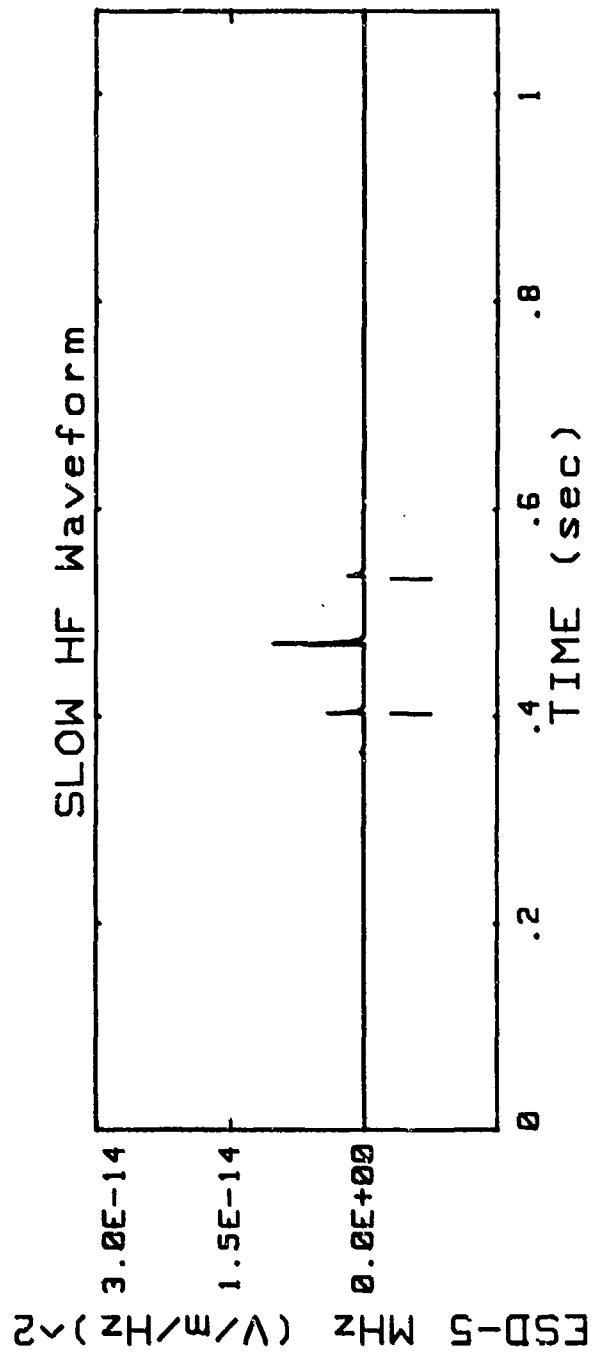
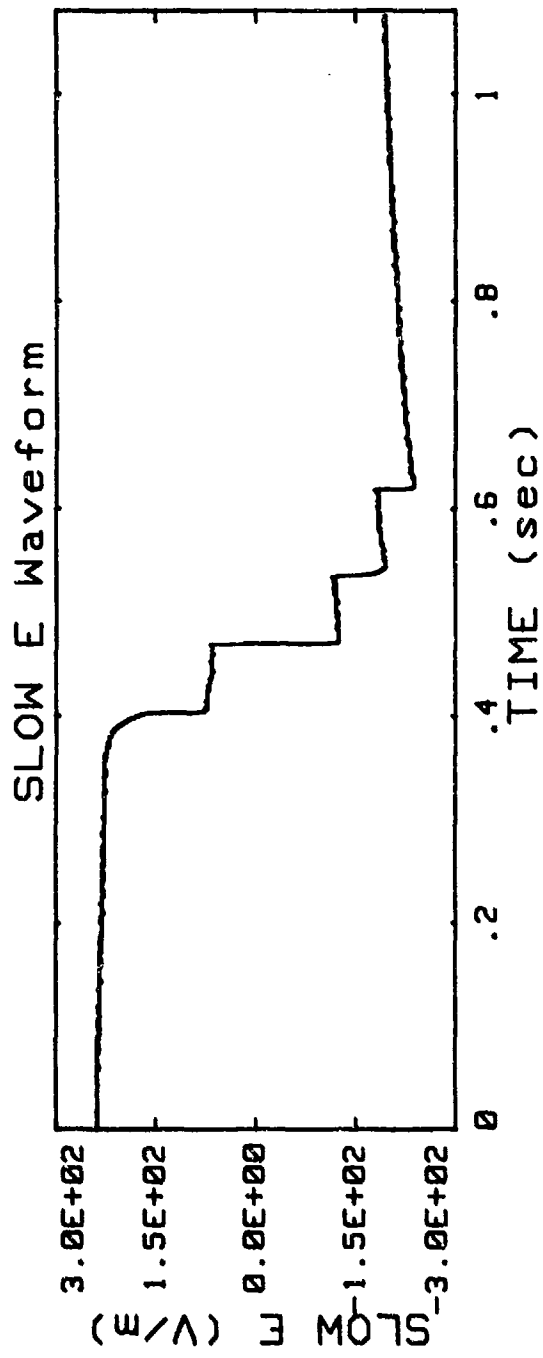


220193202.957 1985

DS Subs RS (10.5 Km)

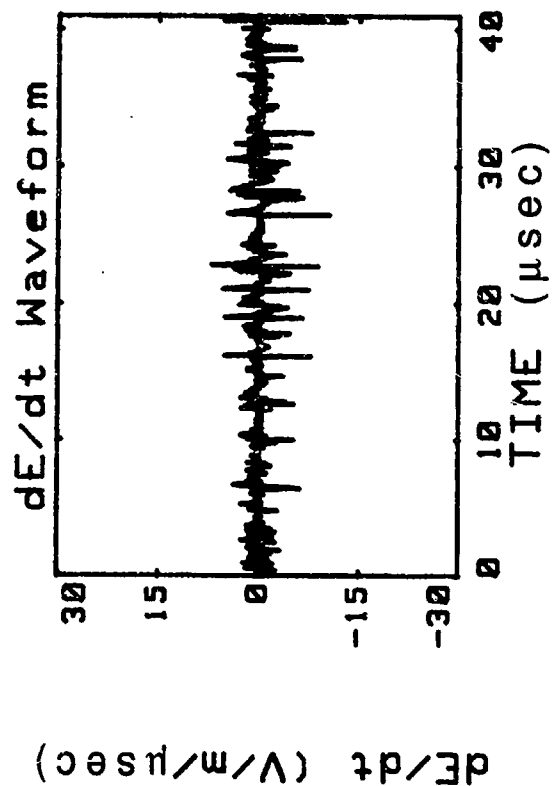
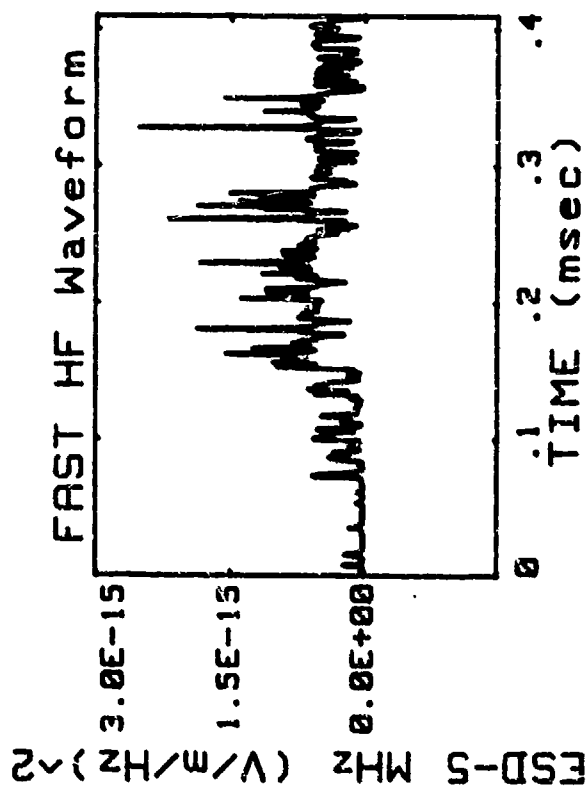
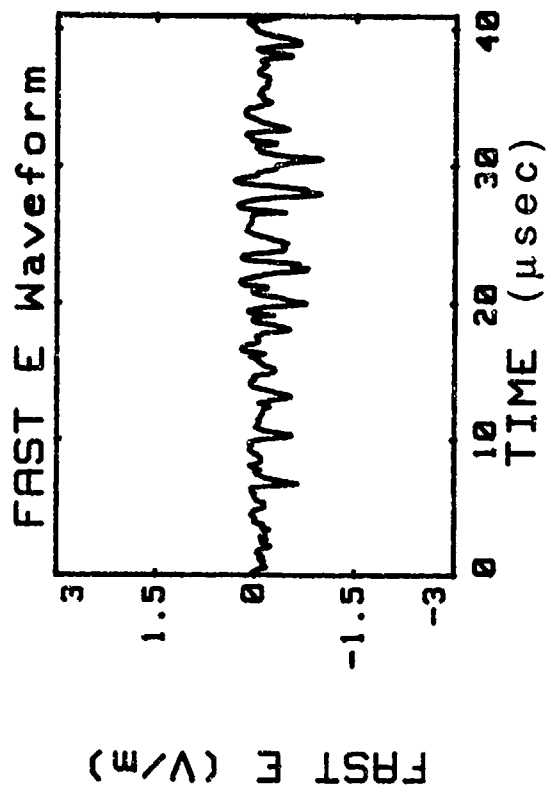
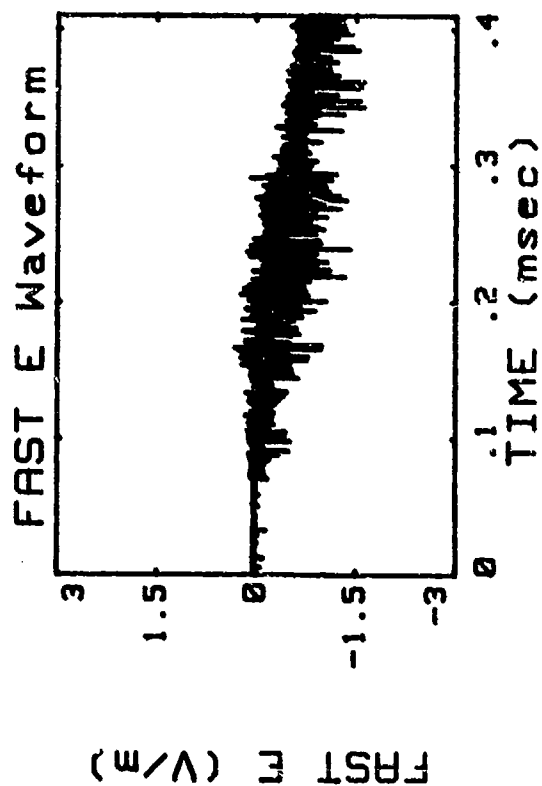


19:32:02.436 8 Aug 1985 (10.5 Km)

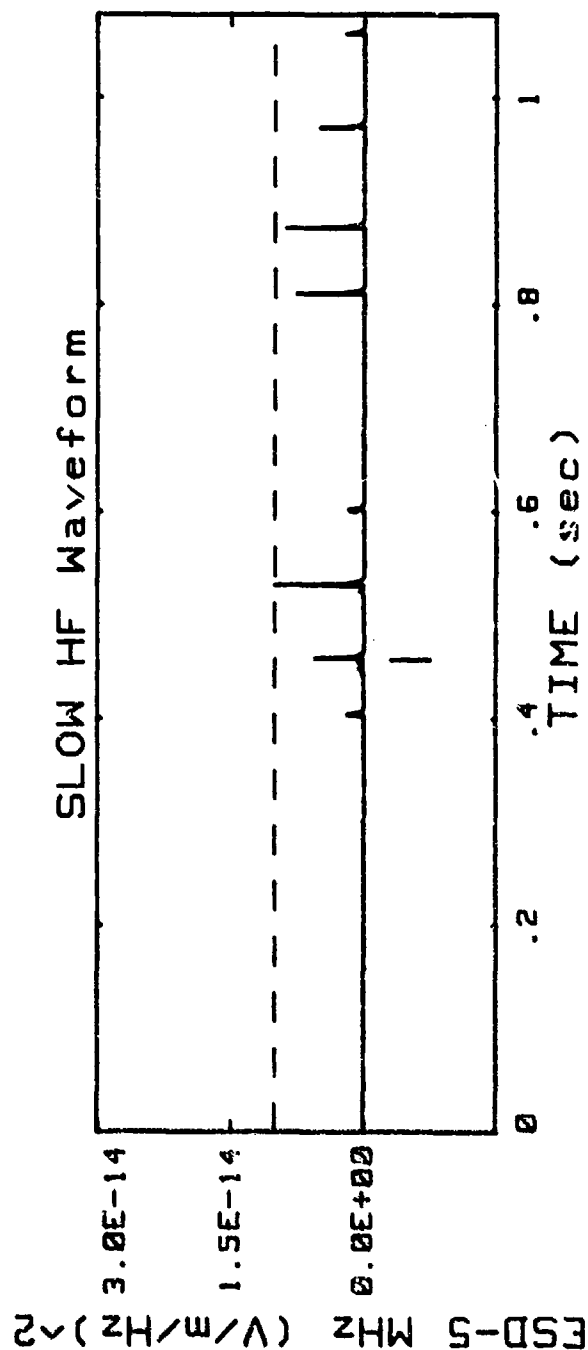
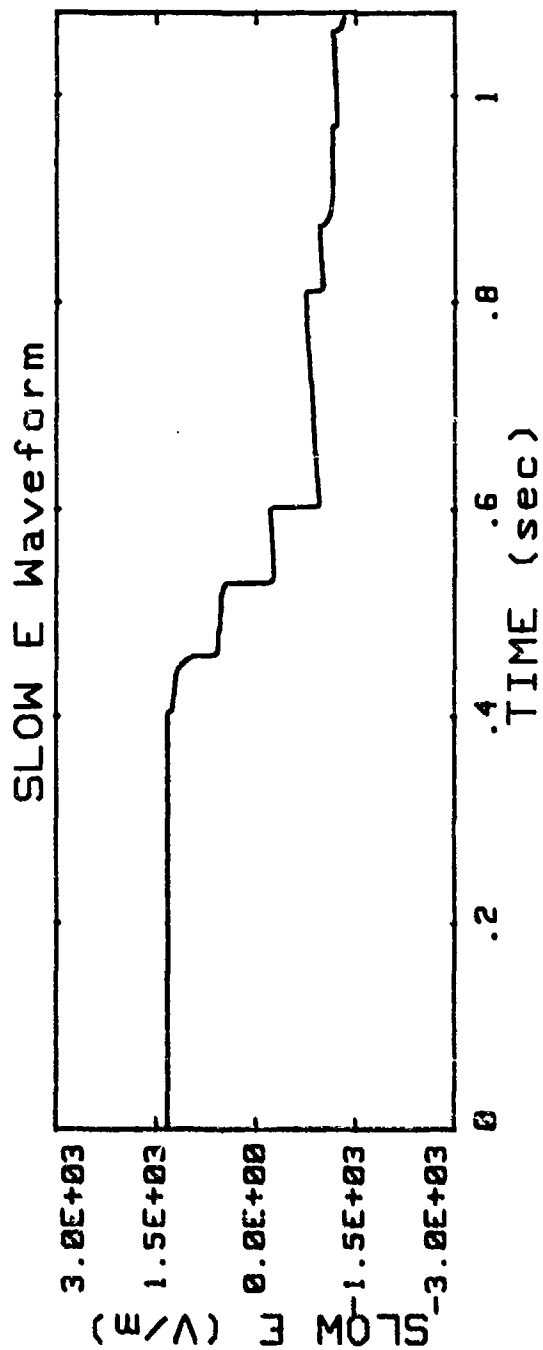


220193224.107 1985

DS Leader (8.1 Km)

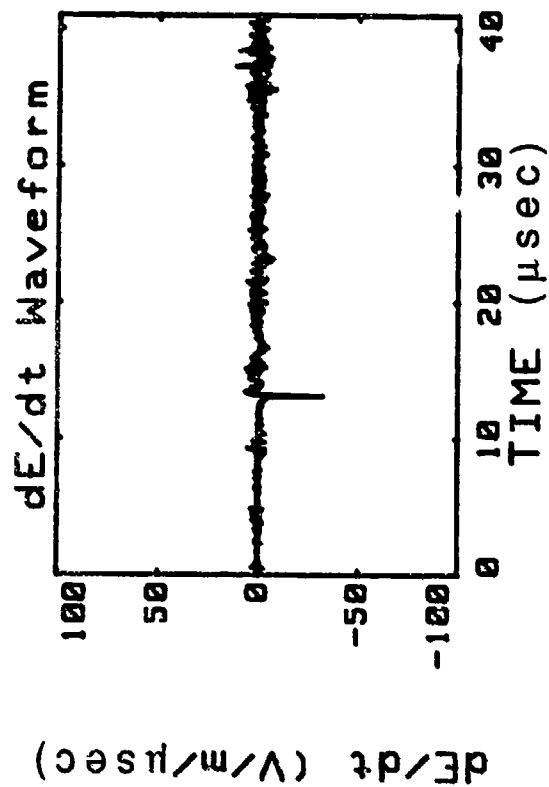
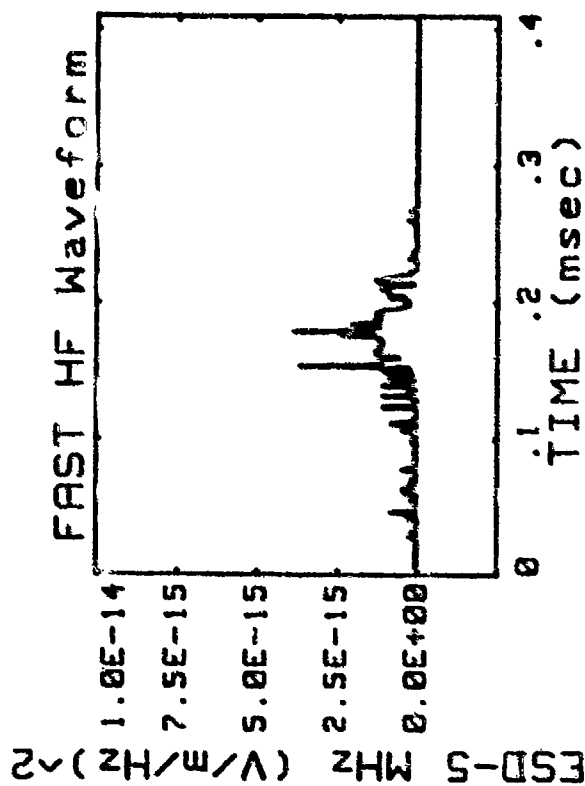
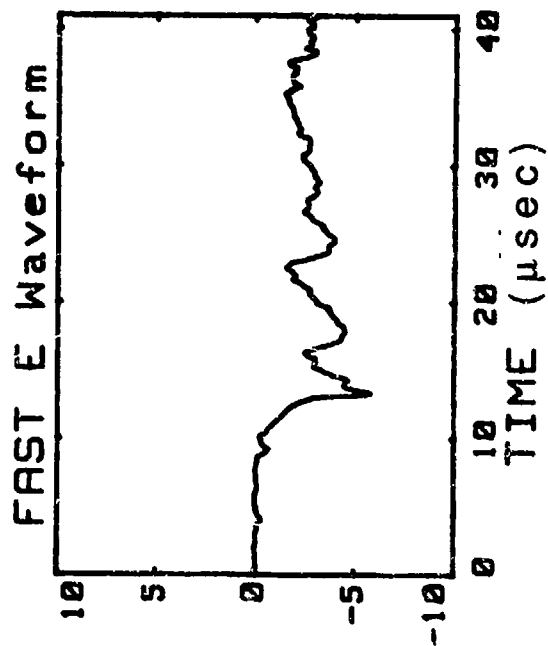
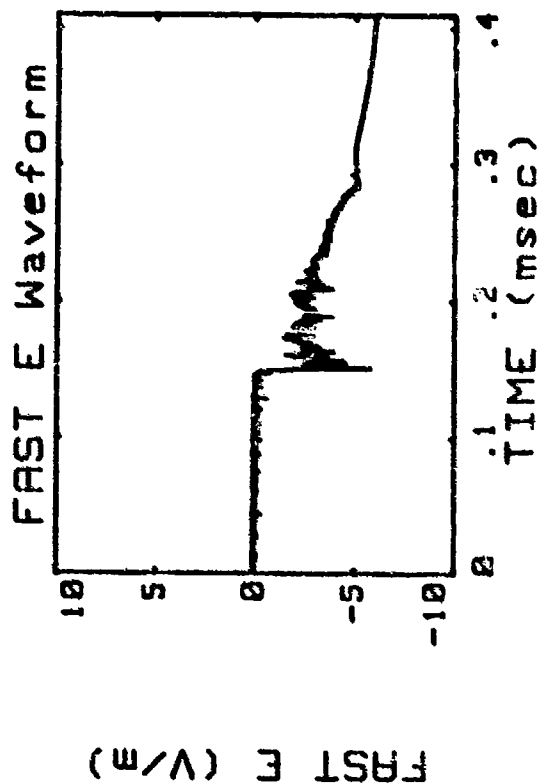


19:32:23.663 8 Aug 1985 (8.1 Km)

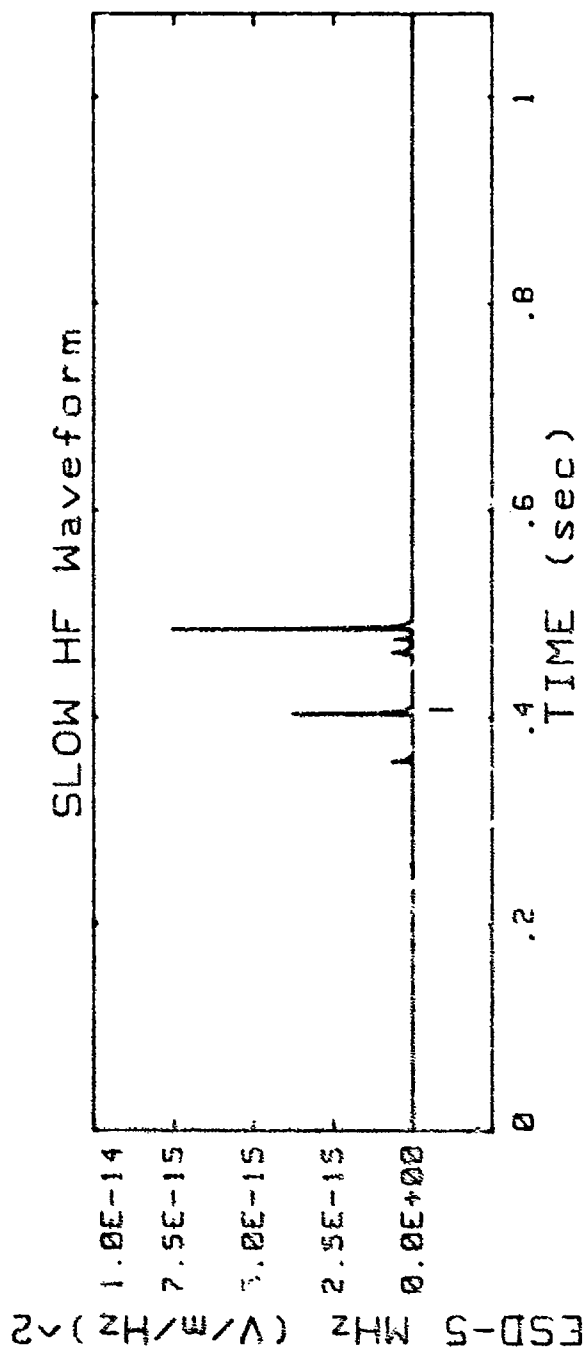
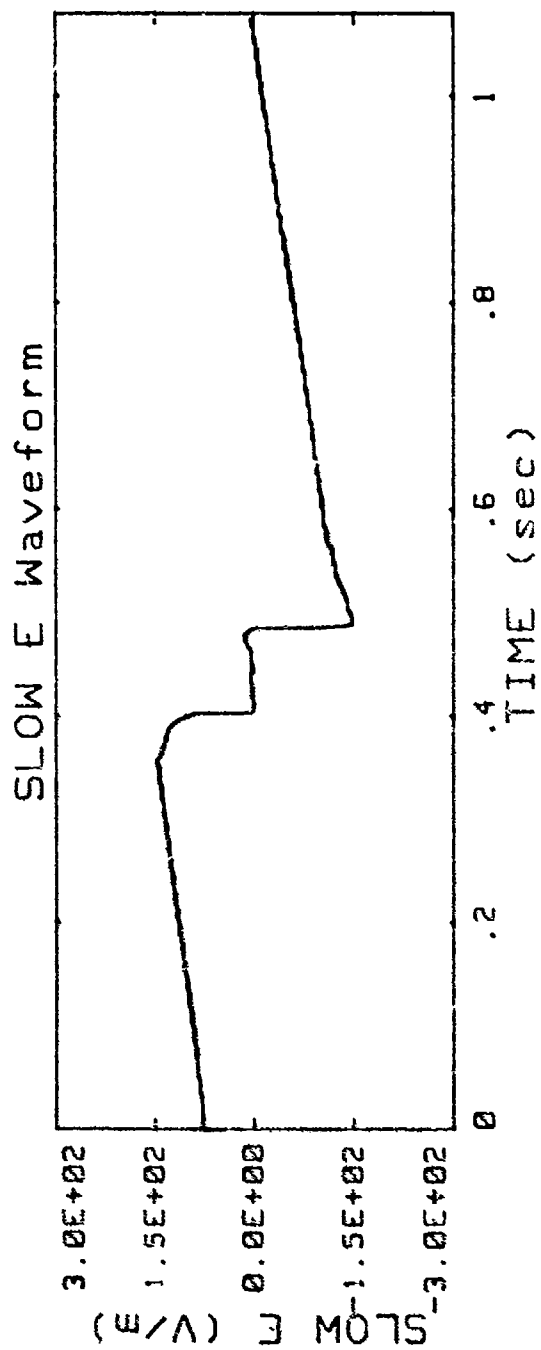


220193234.190 1985

1st RS (11.6 Km)

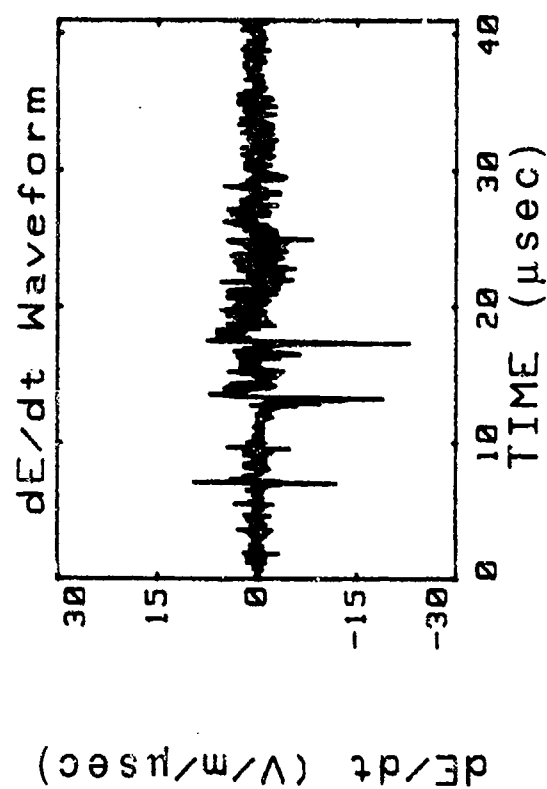
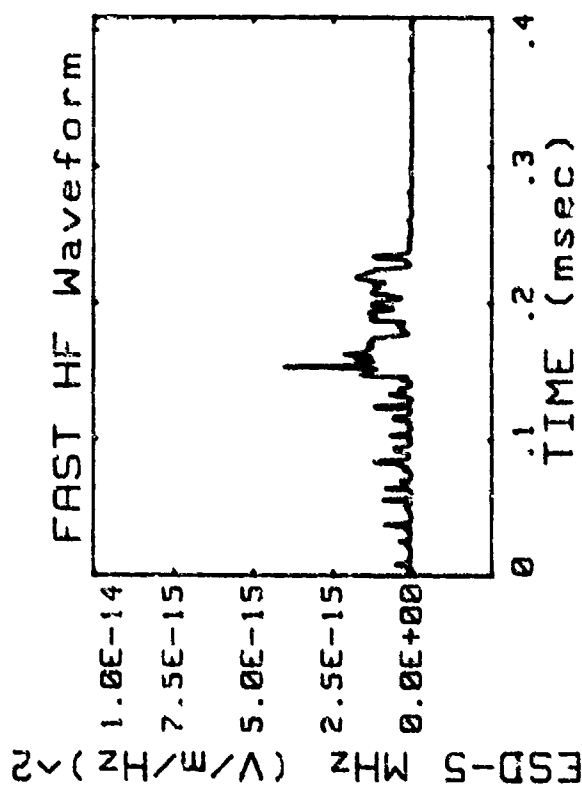
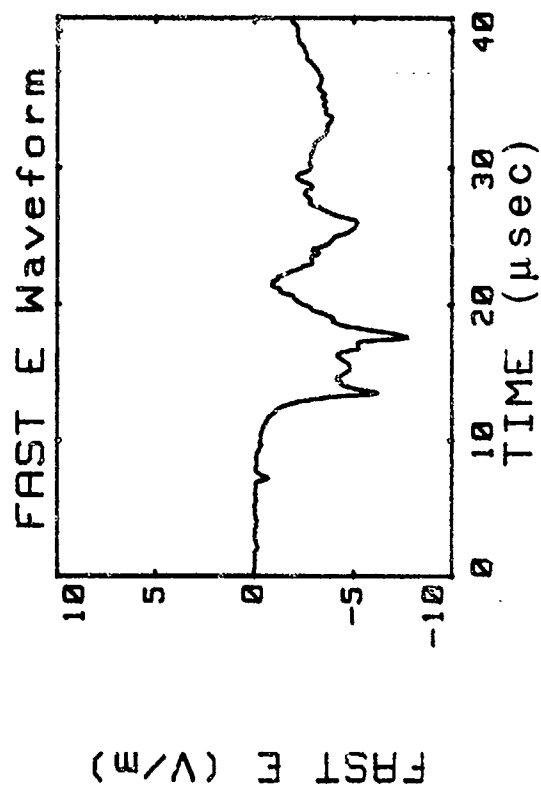
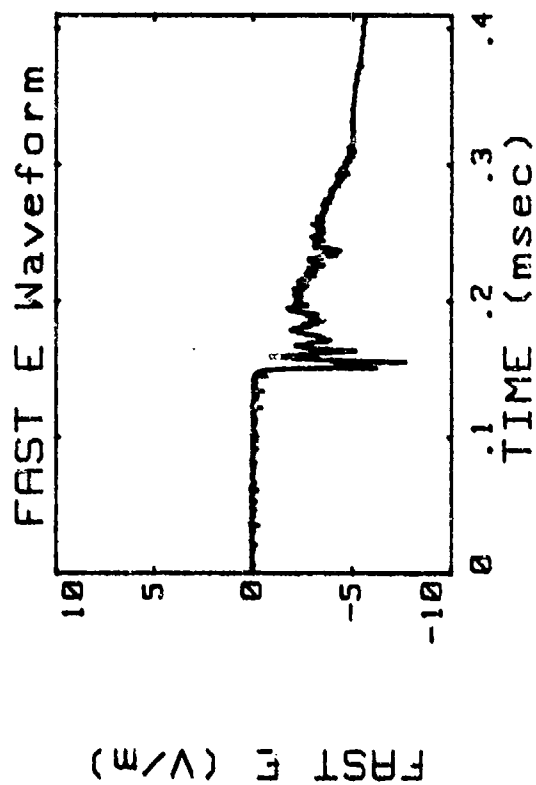


19:32:33.795 8 Aug 1985 (11.6 Km)

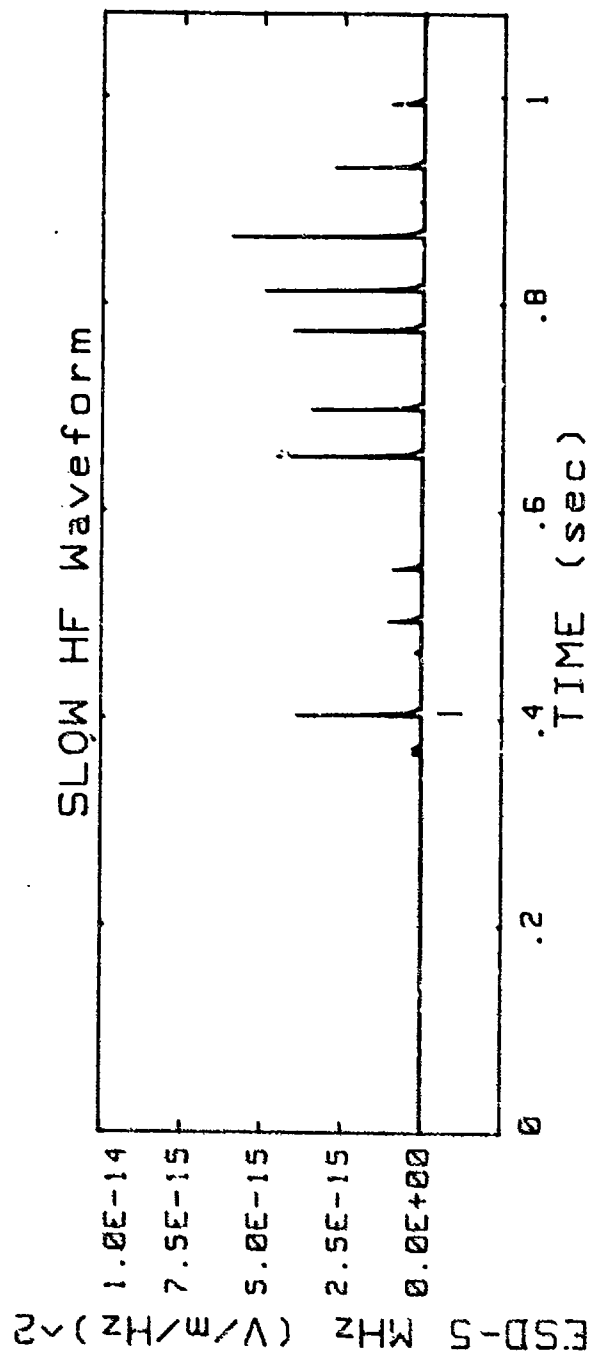
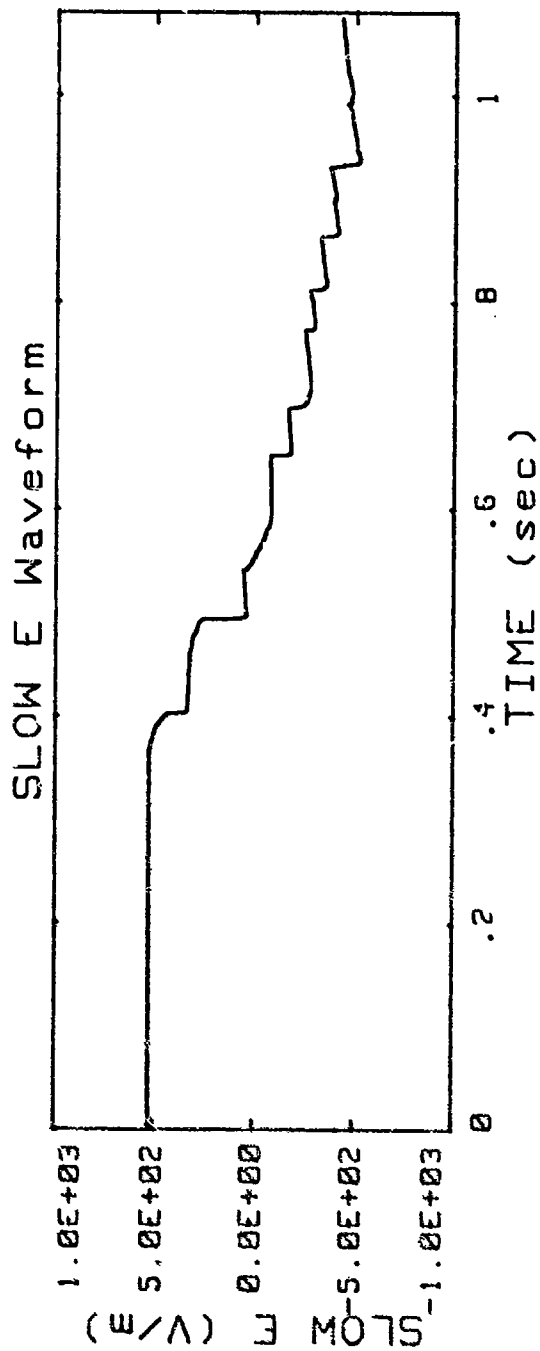


220193246.501 1985

Multiple Gnd RS (12.2 Km)

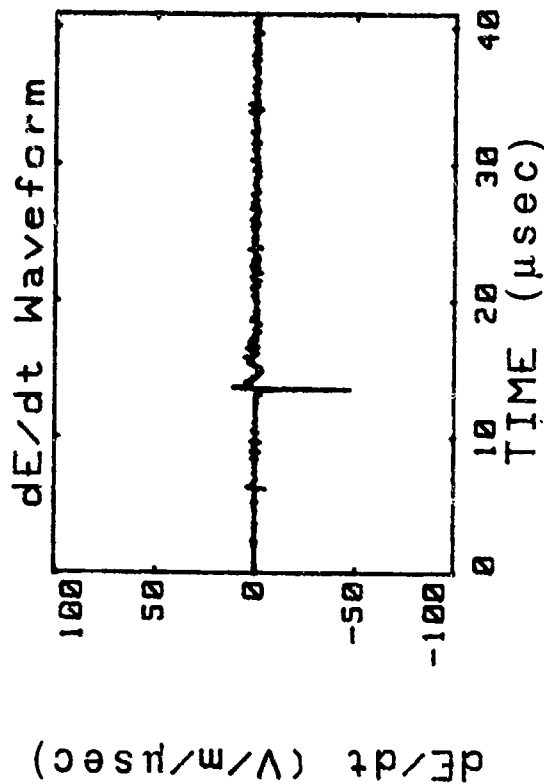
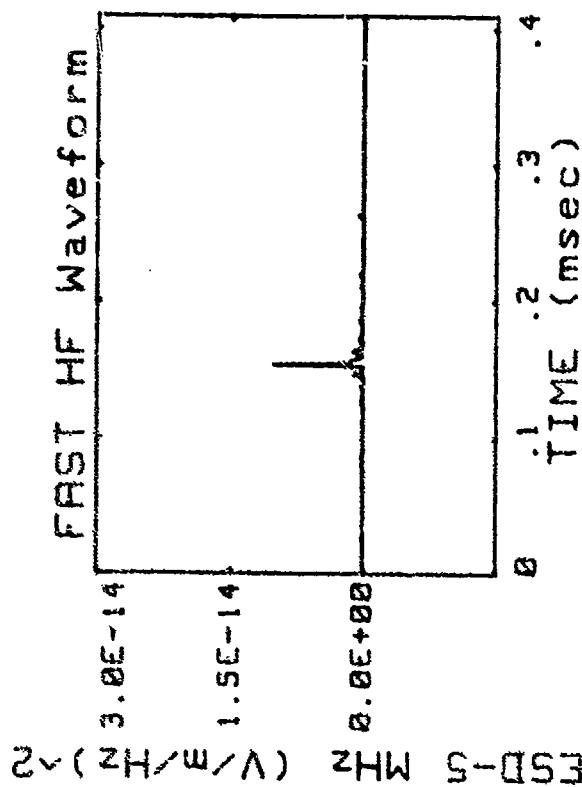
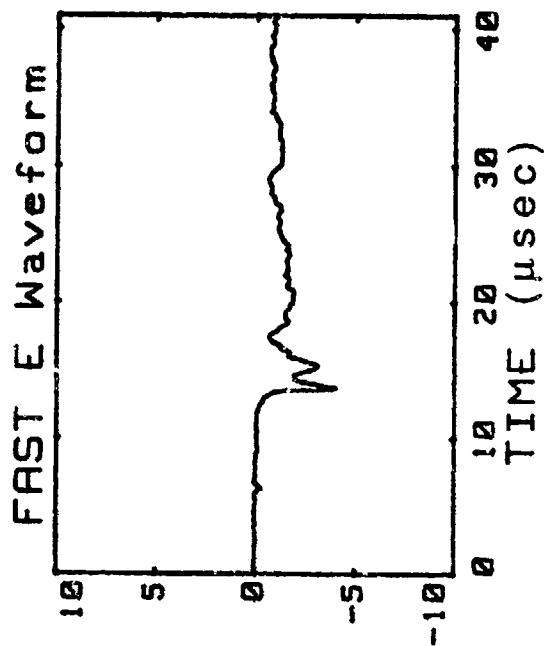
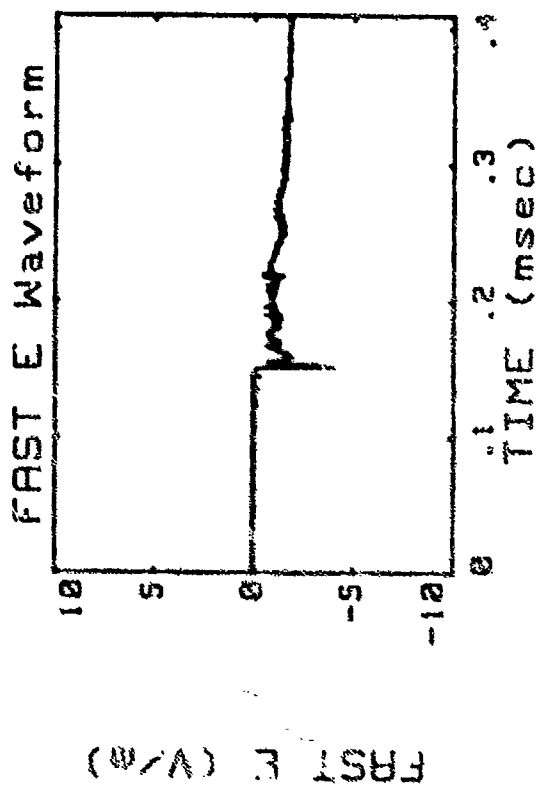


19:32:46.108 8 Aug 1985 (12.2 Km)

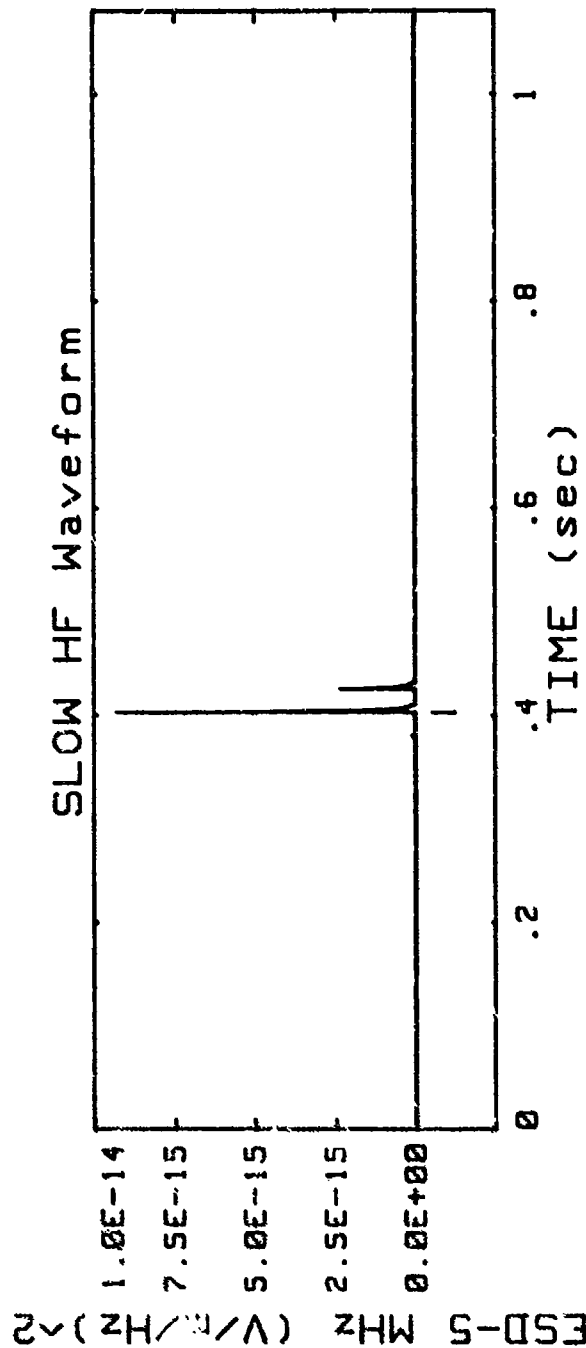
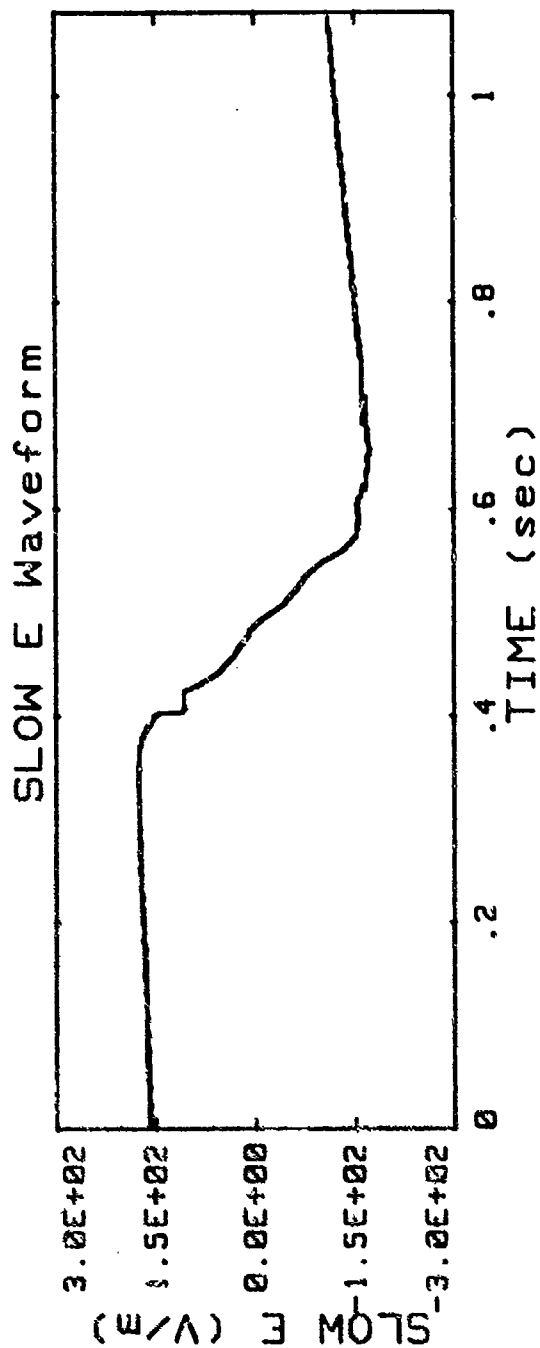


220193258.525 1985

1st RS (12.4 Km)

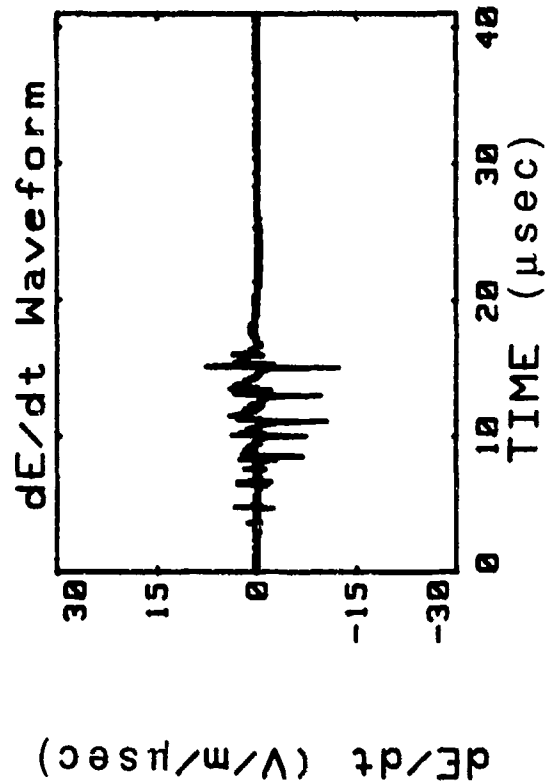
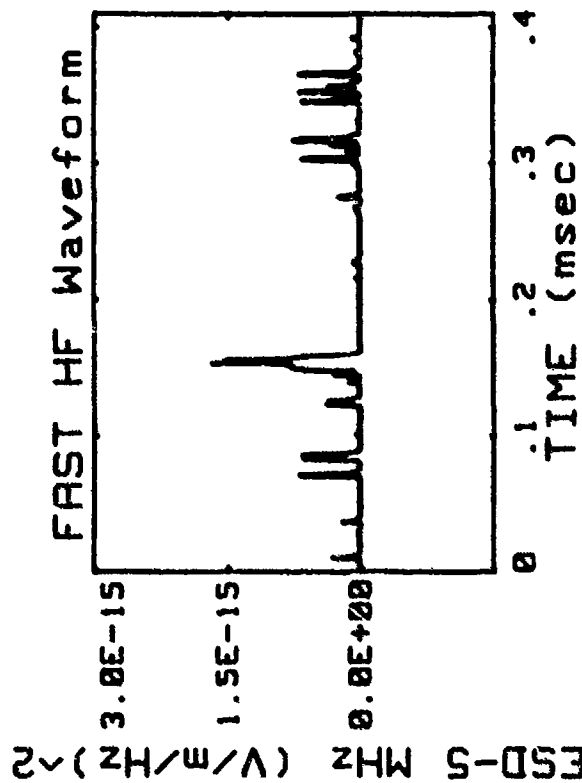
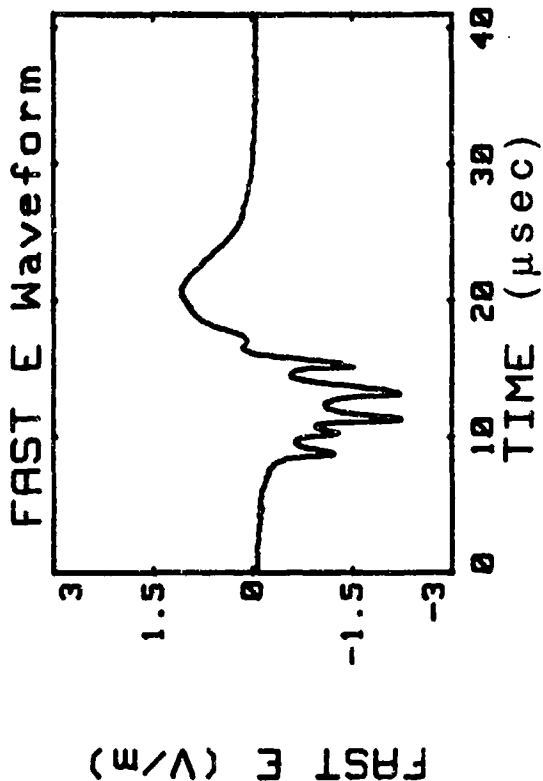
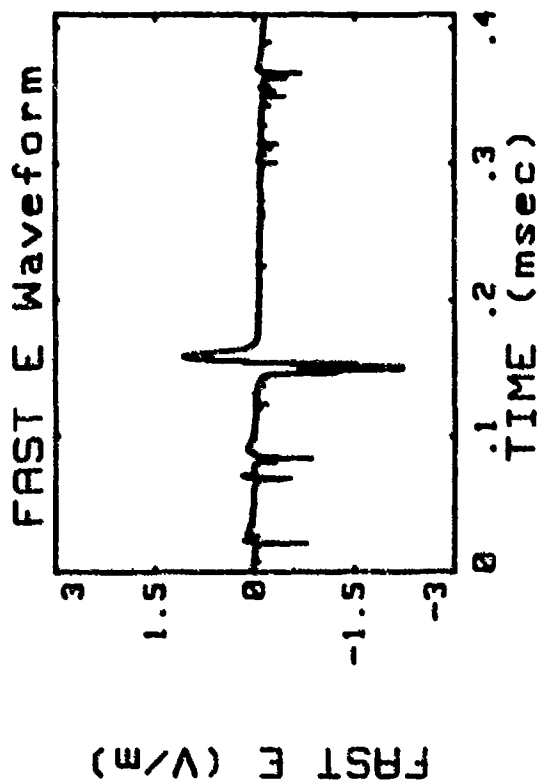


19:32:58.135 8 Aug 1985 (12.4 Km)

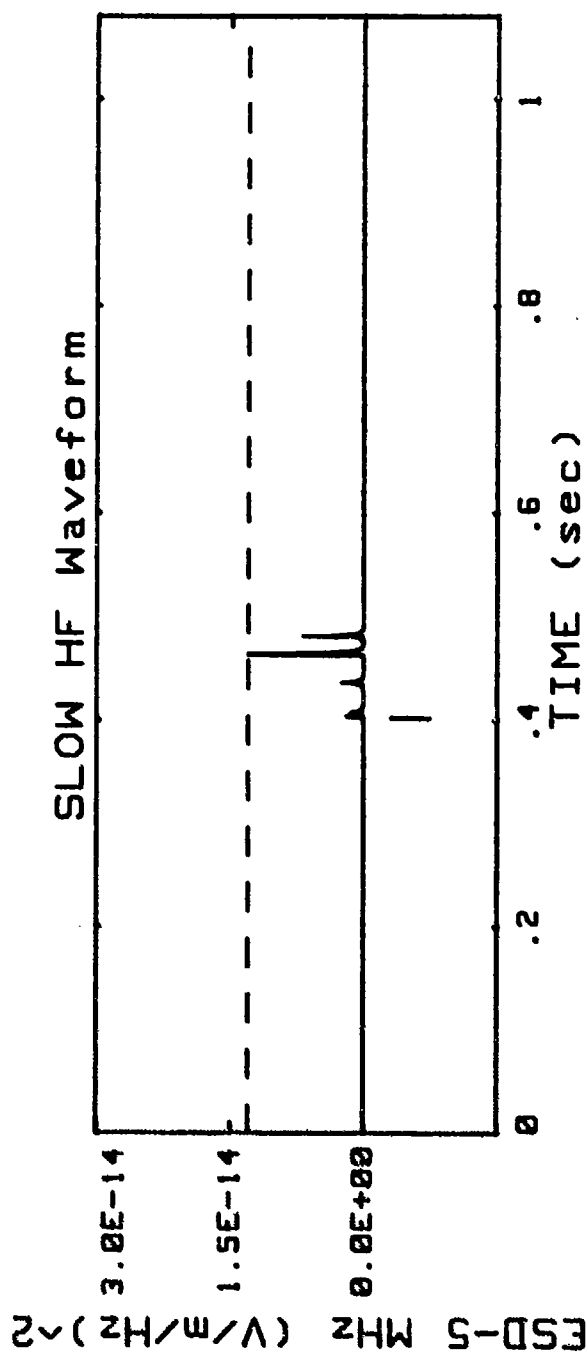
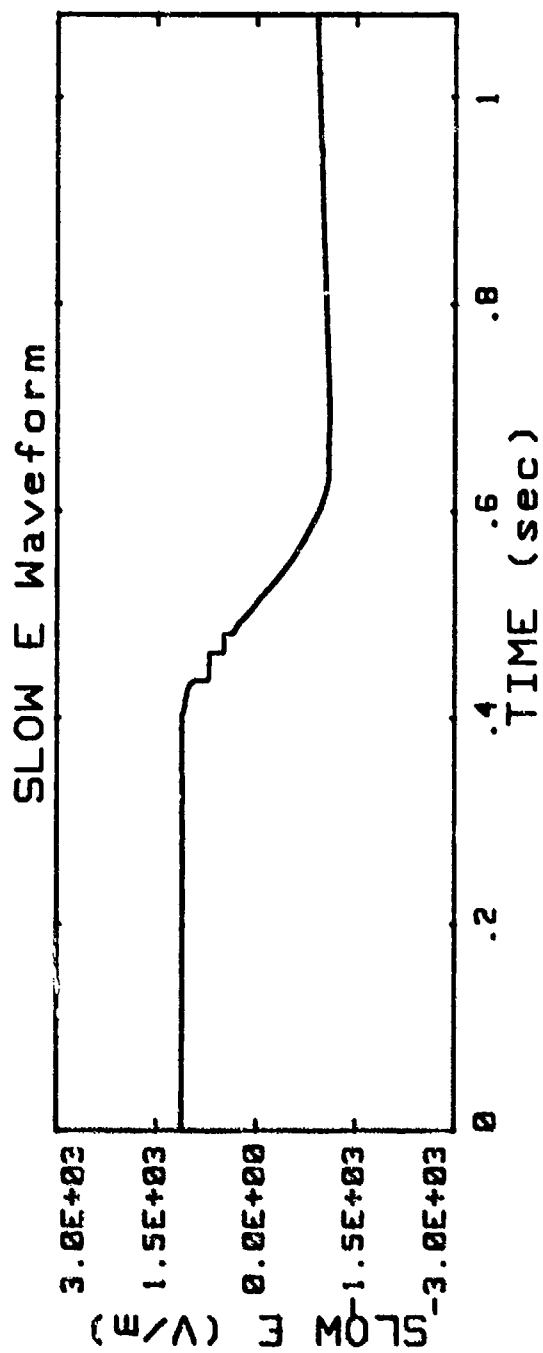


220193310.845 1985

Char Cloud Pulse (9.2 Km)

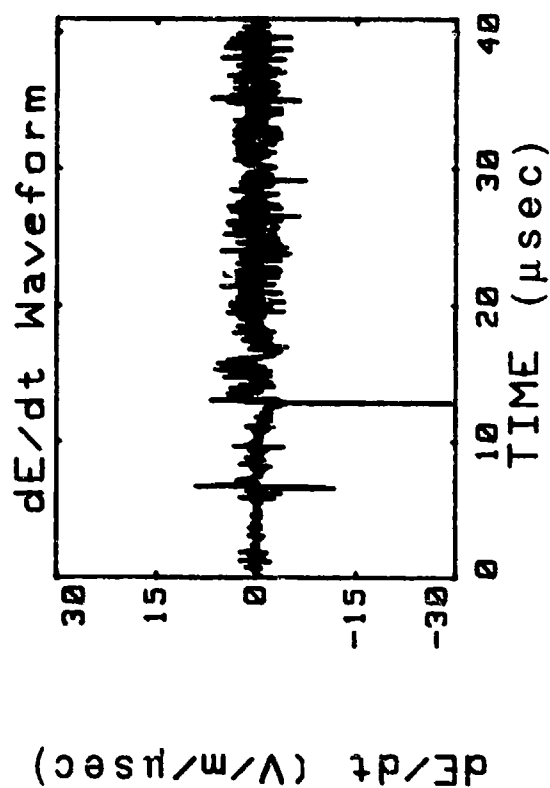
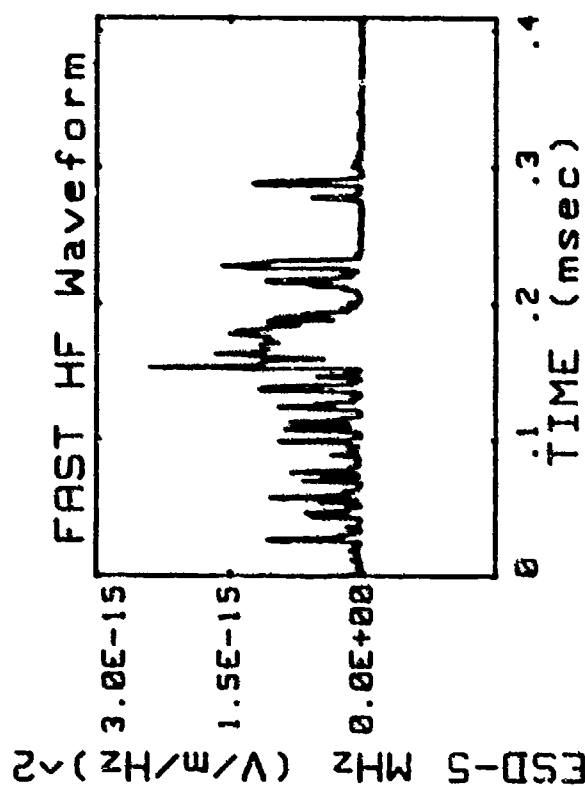
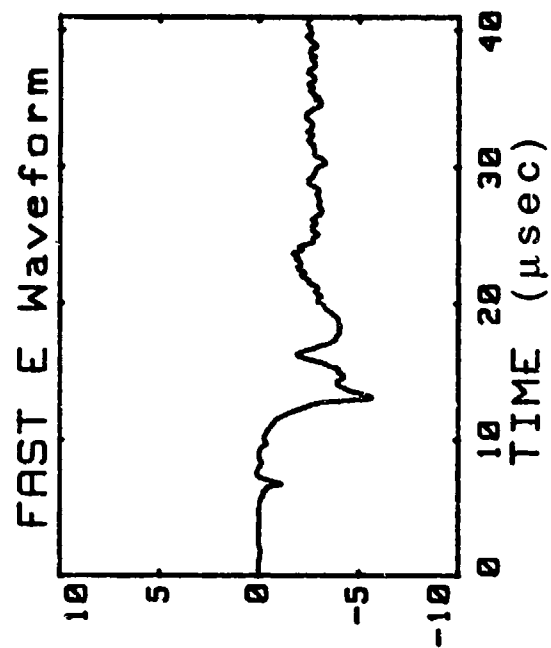
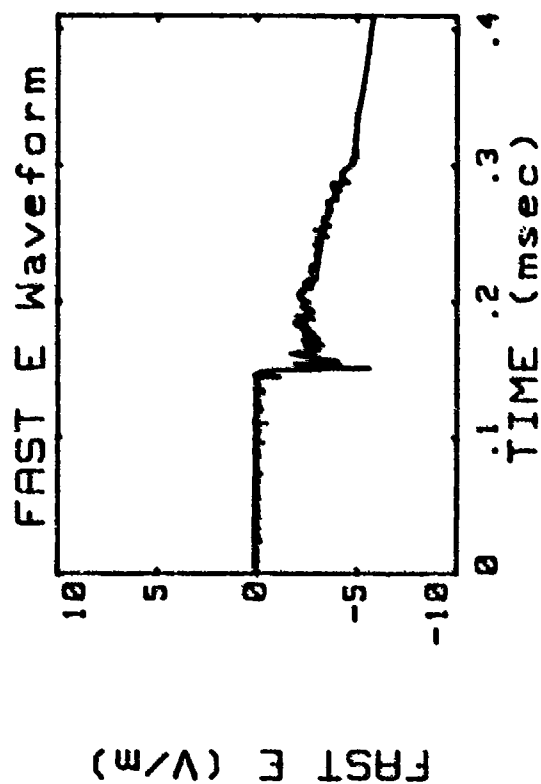


19:33:10.456 8 Aug 1985 (9.2 Km)

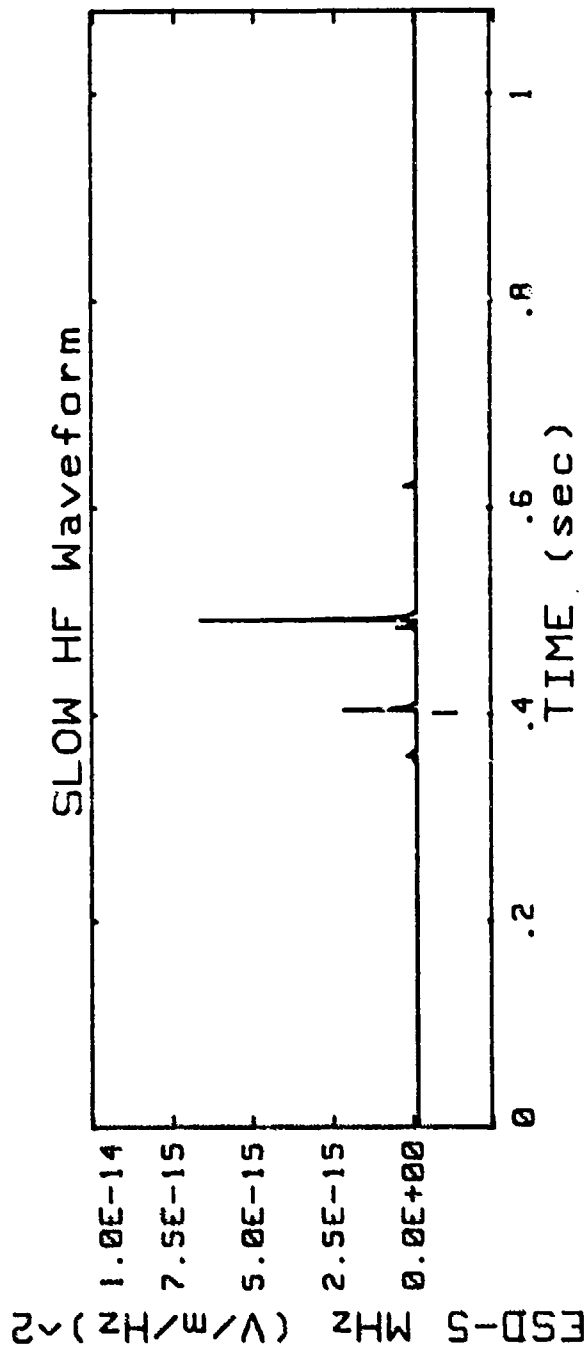
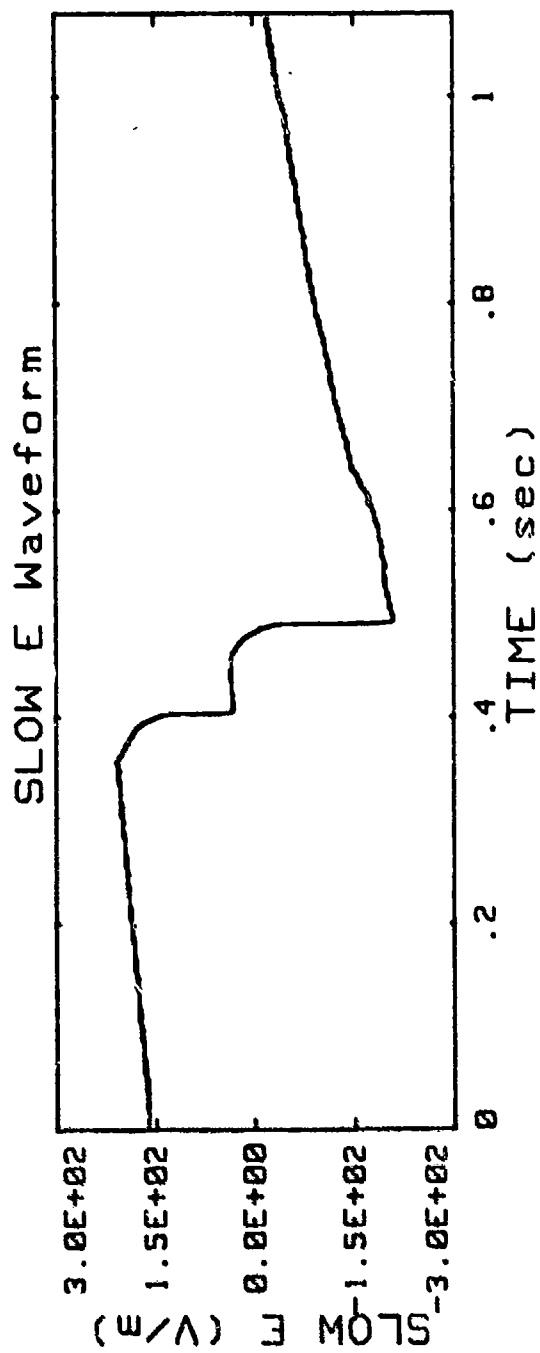


220193318.134 1985

1st RS (11.5 Km)

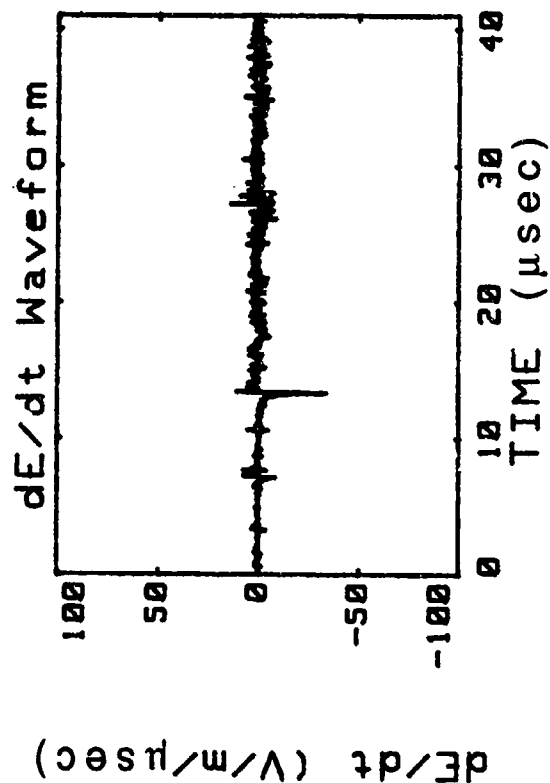
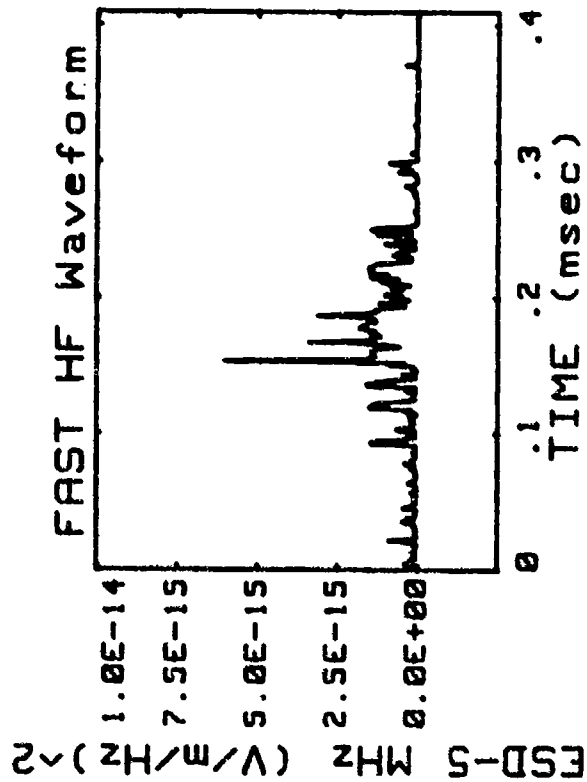
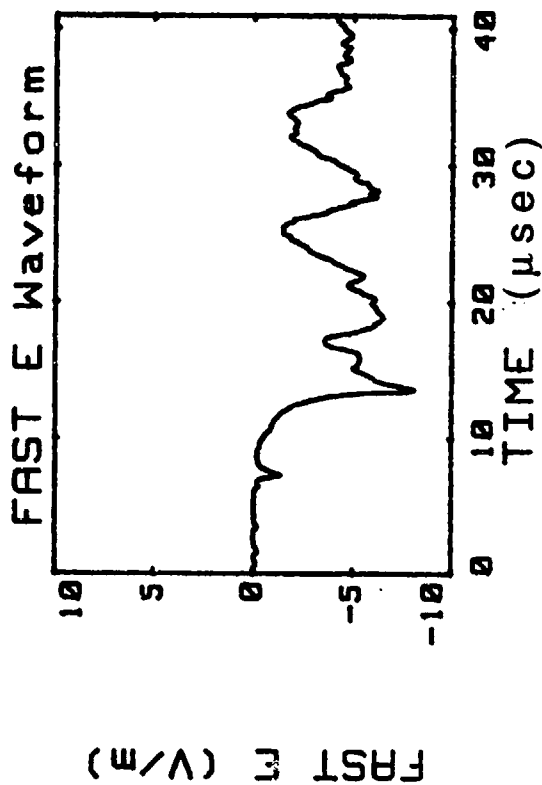
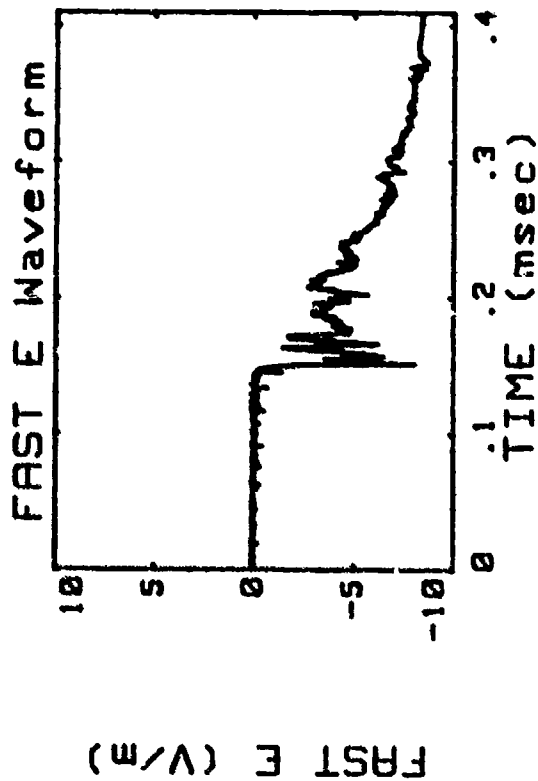


19:33:17.746 8 Aug 1985 (11.5 Km)



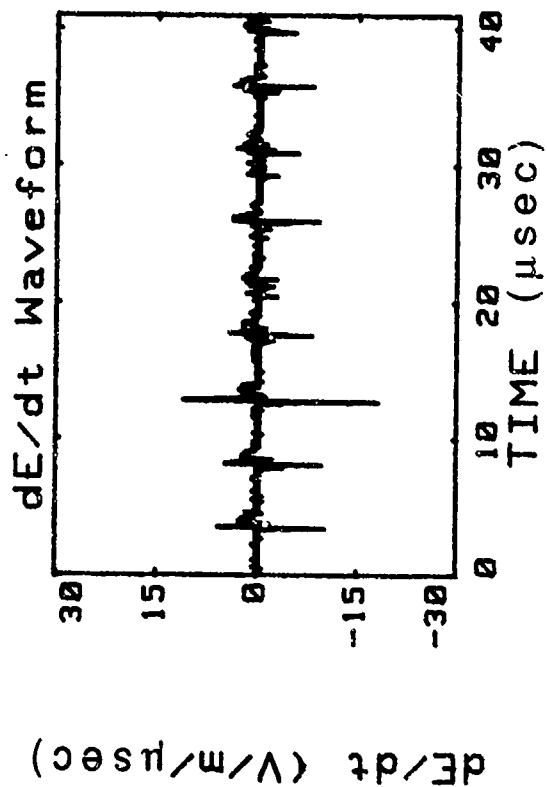
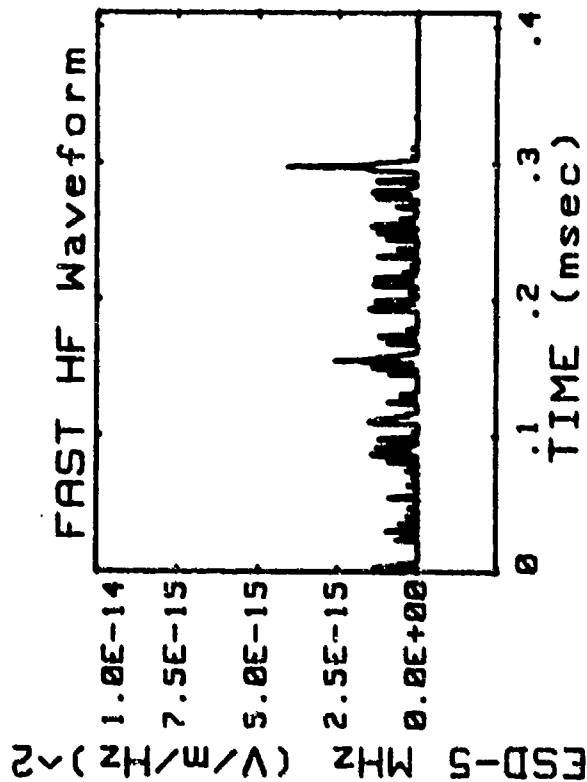
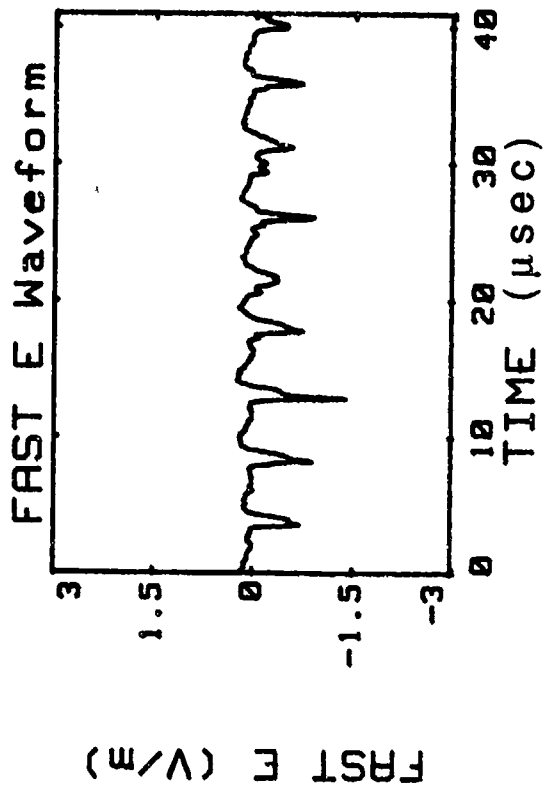
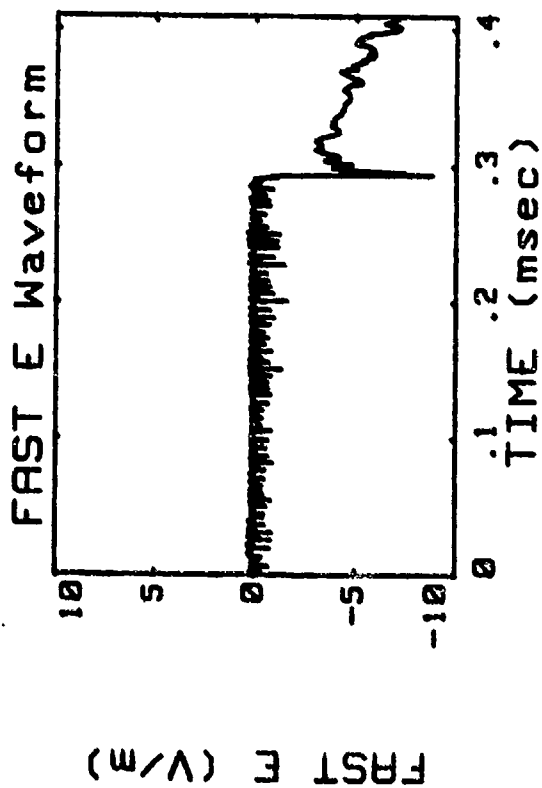
220193327.630 1985

1st RS (12.7 Km)

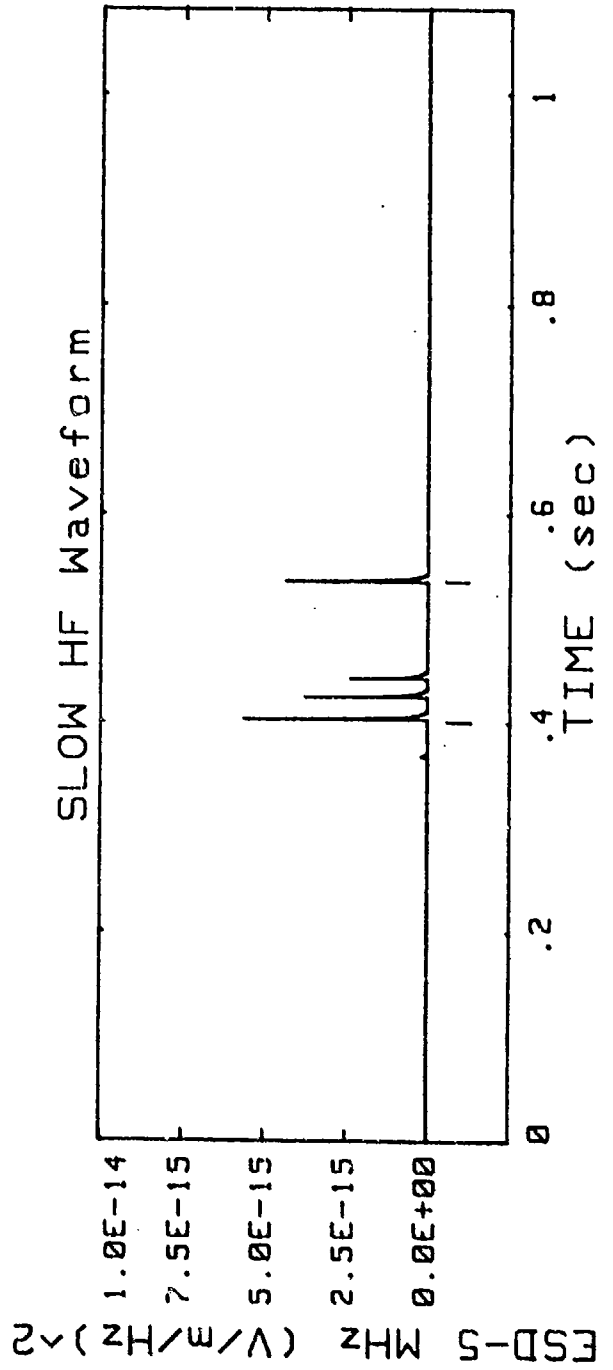
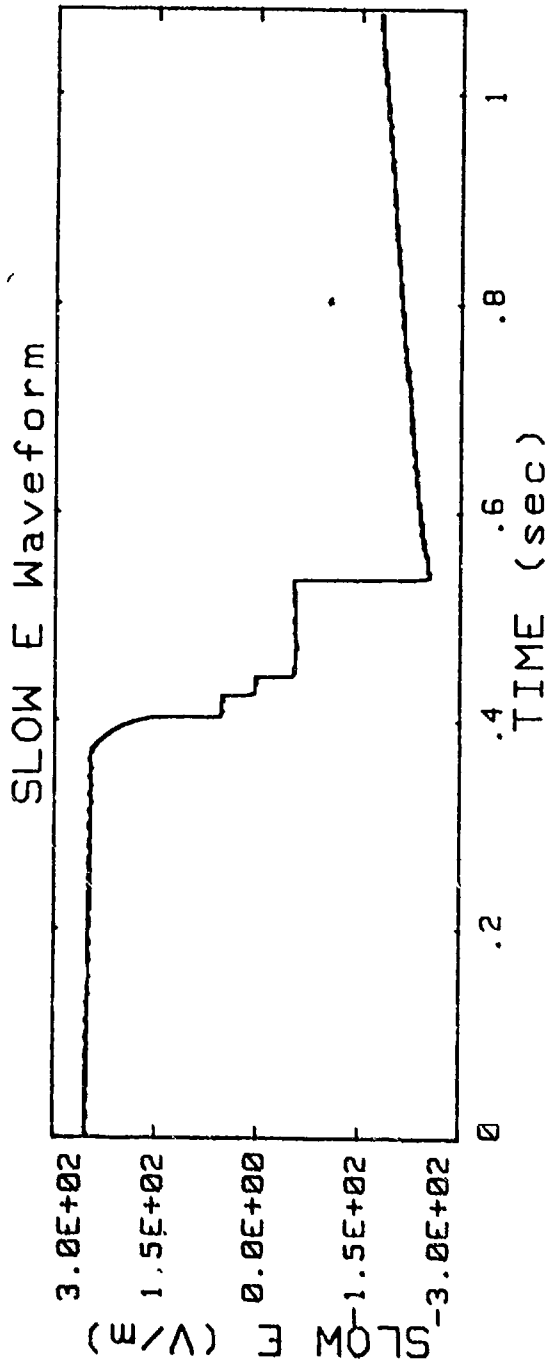


220193327.763 1985

DS Leader (12.7 Km)

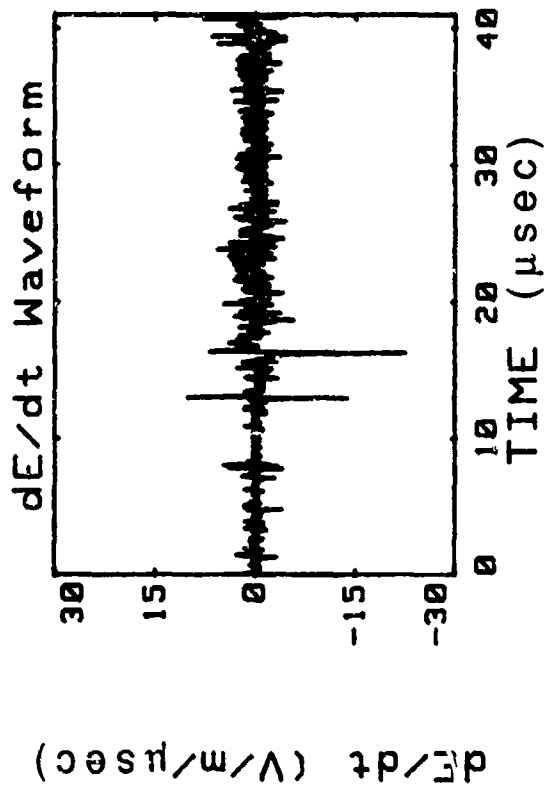
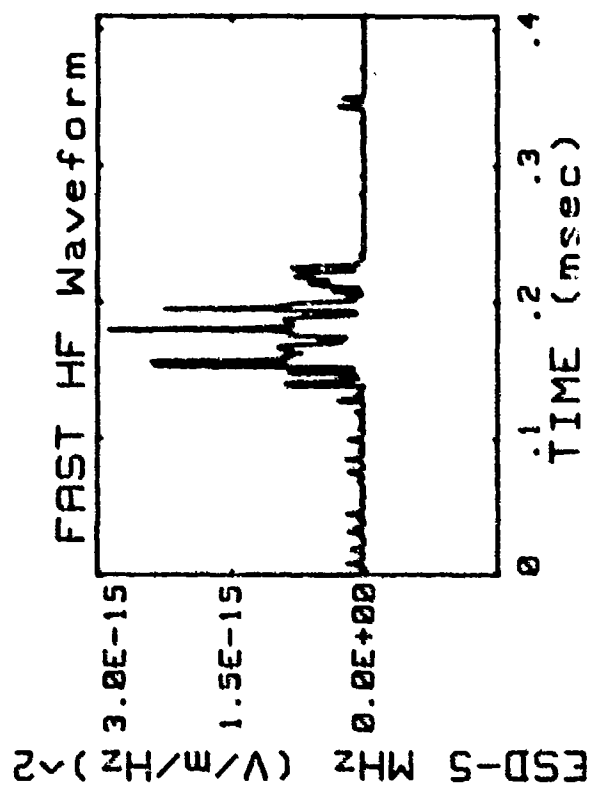
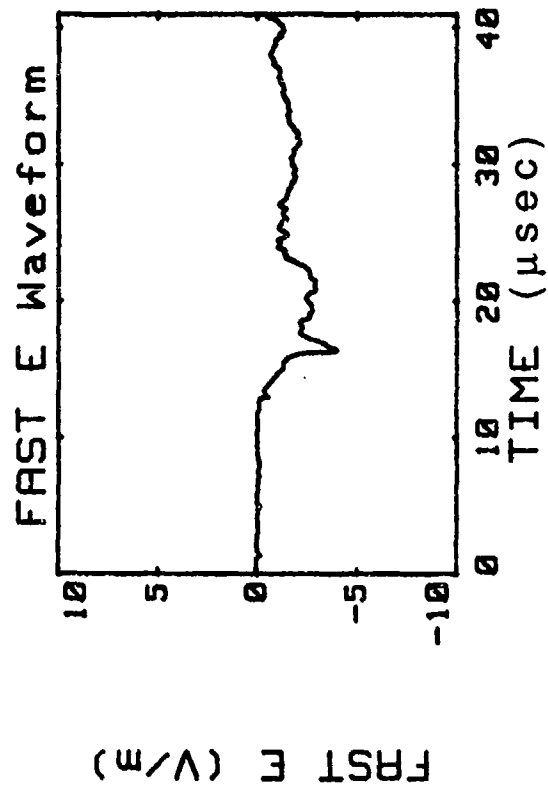
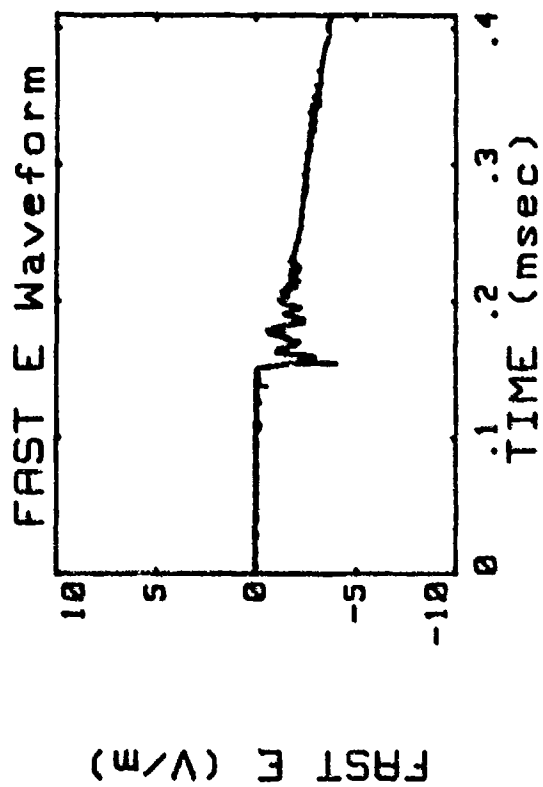


19:33:27.240 8 Aug 1985 (12.7 Km)



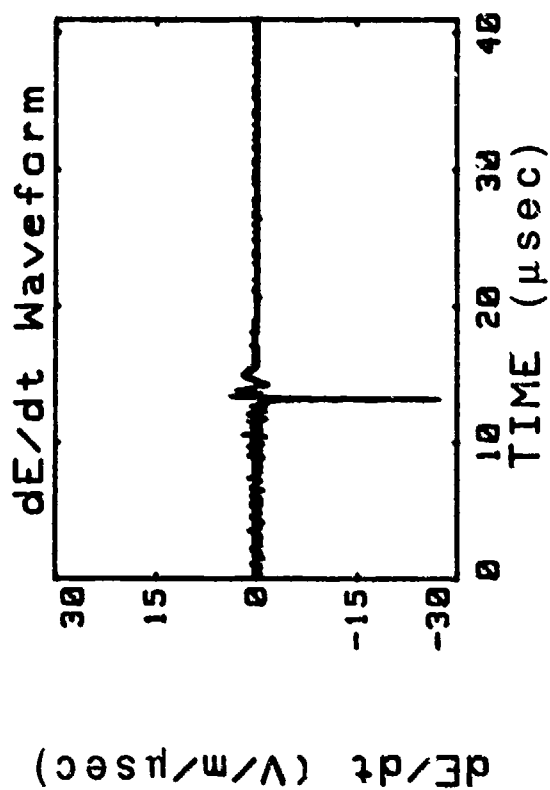
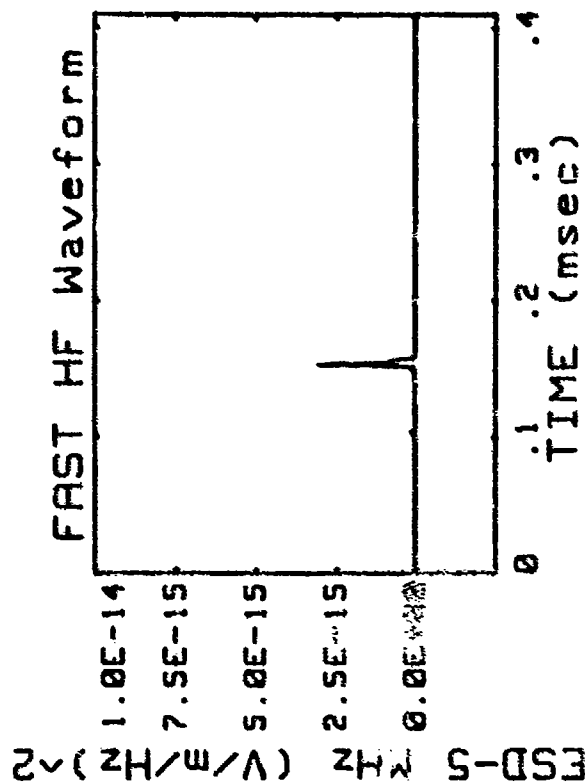
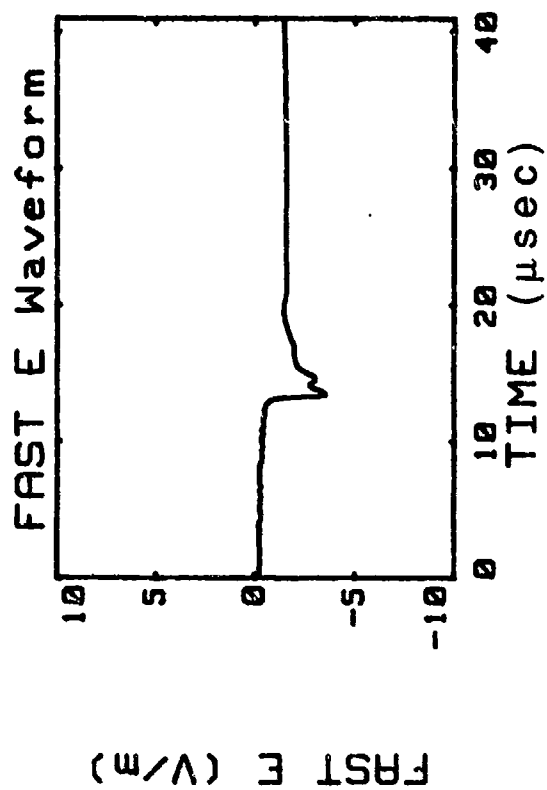
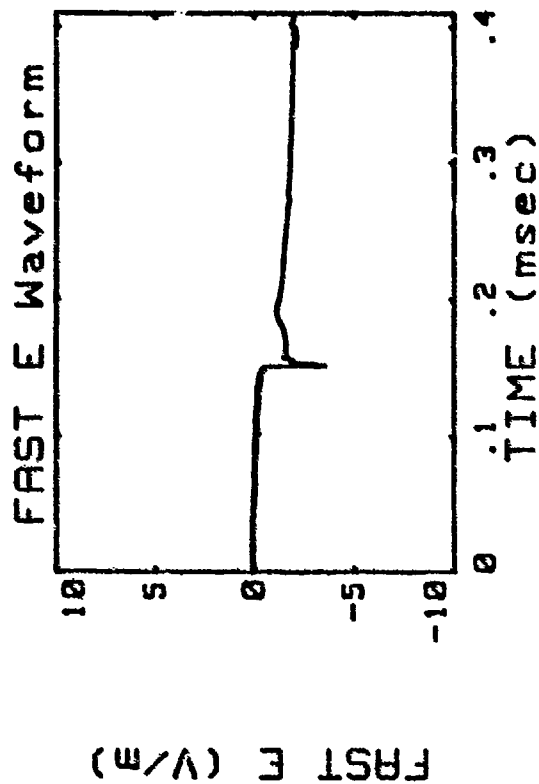
220193335.877 1985

1st RS (9.9 Km)



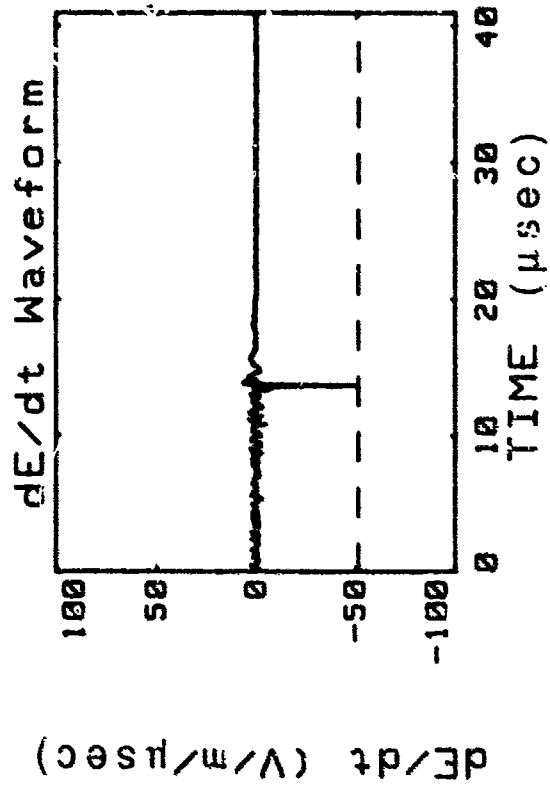
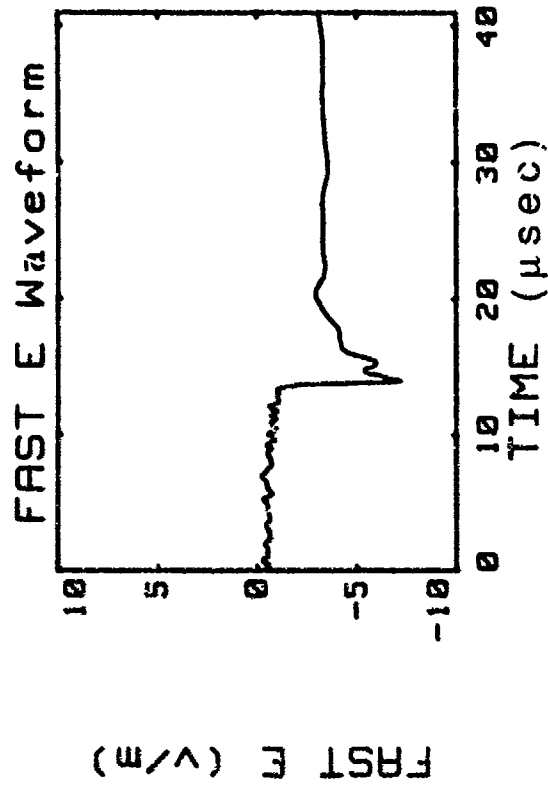
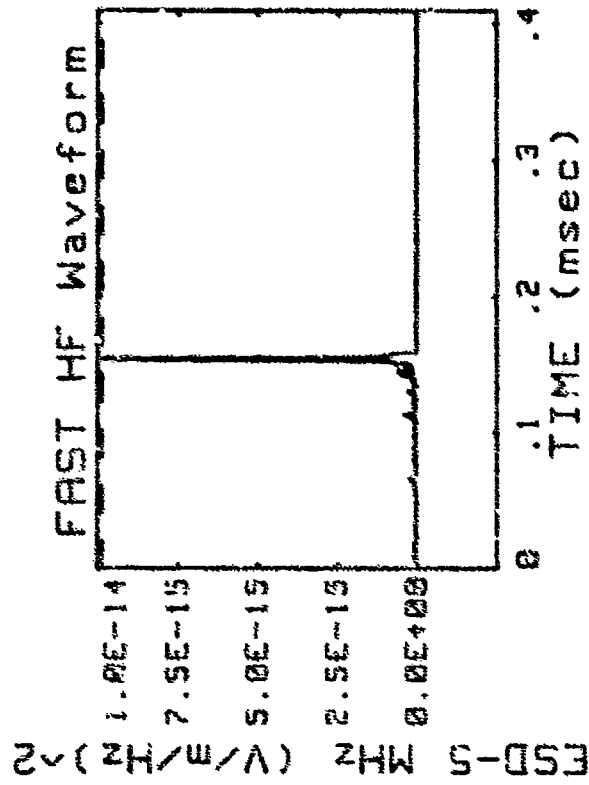
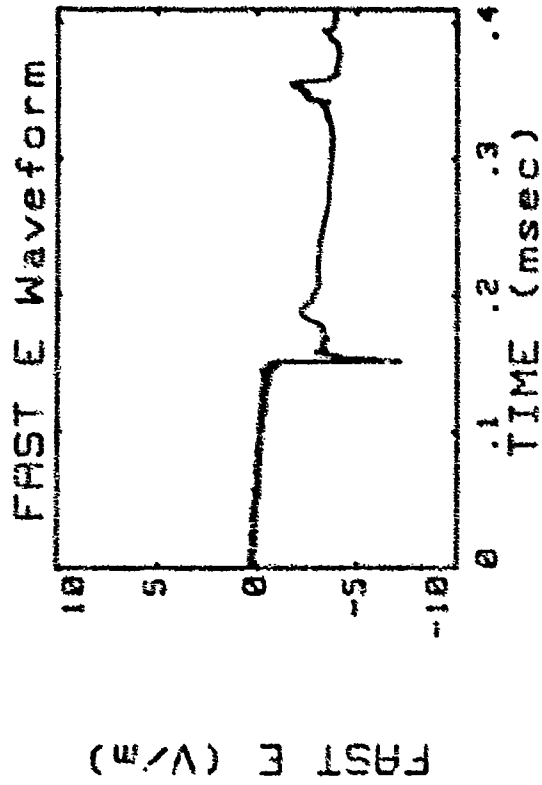
220193336.047 1985

Norm Subs RS (9.9 Km)

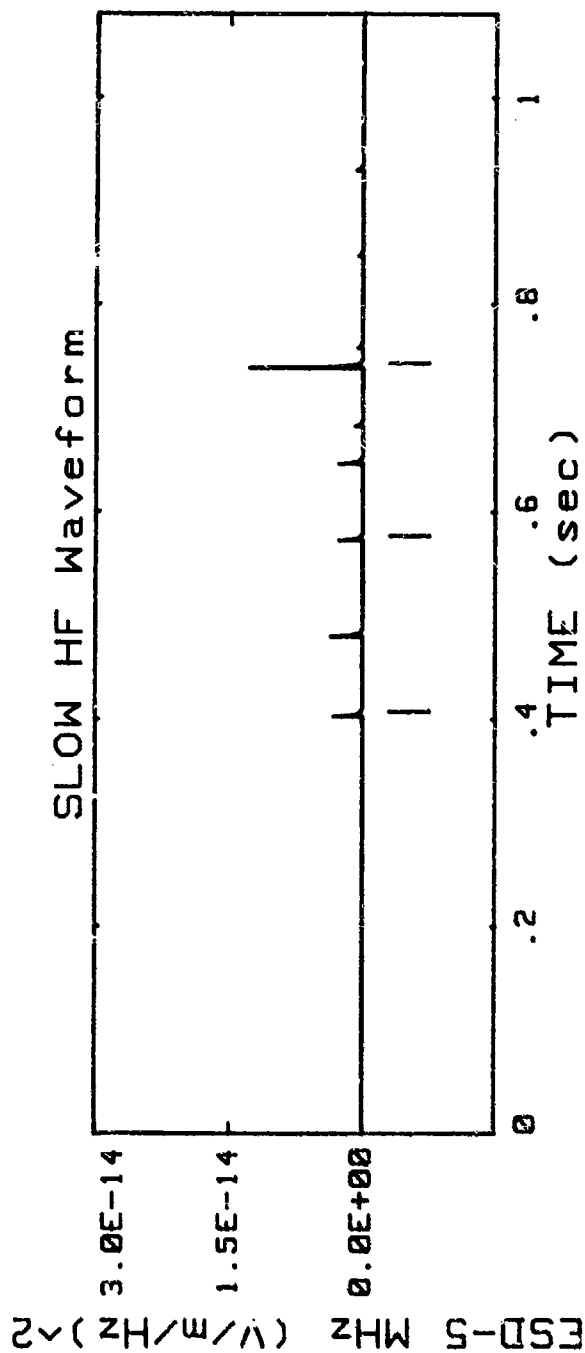
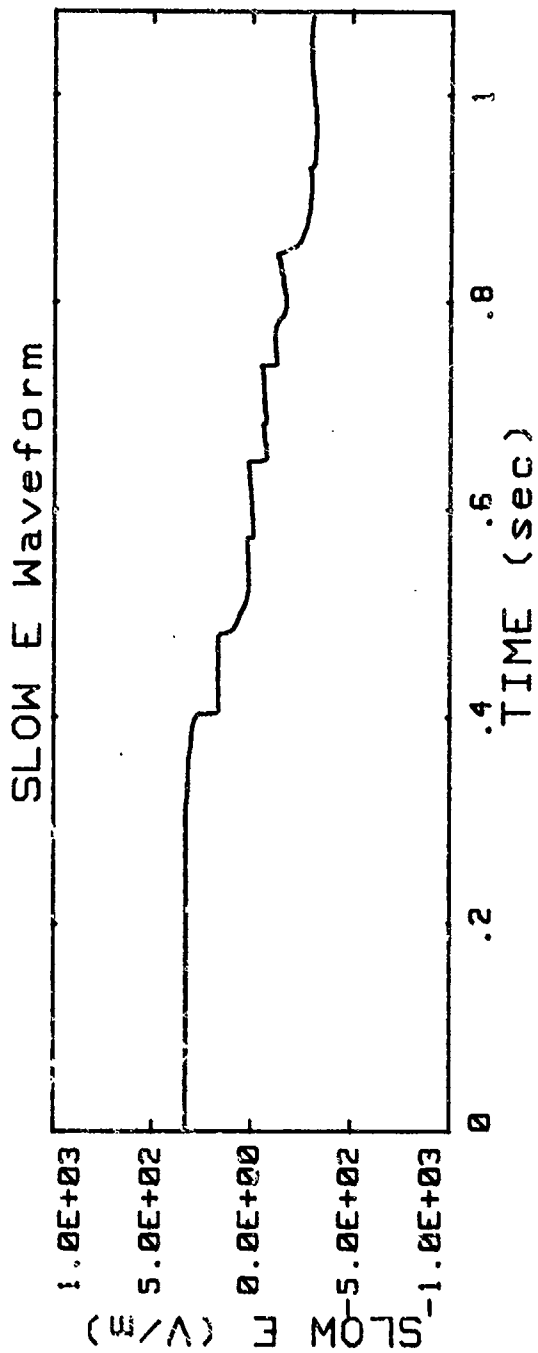


220193336.213 1985

Chaotic Leader (9.9 Km)

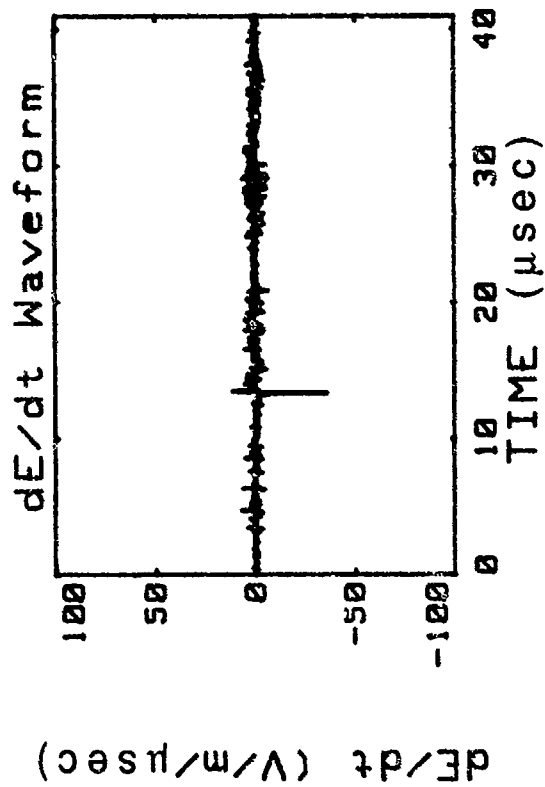
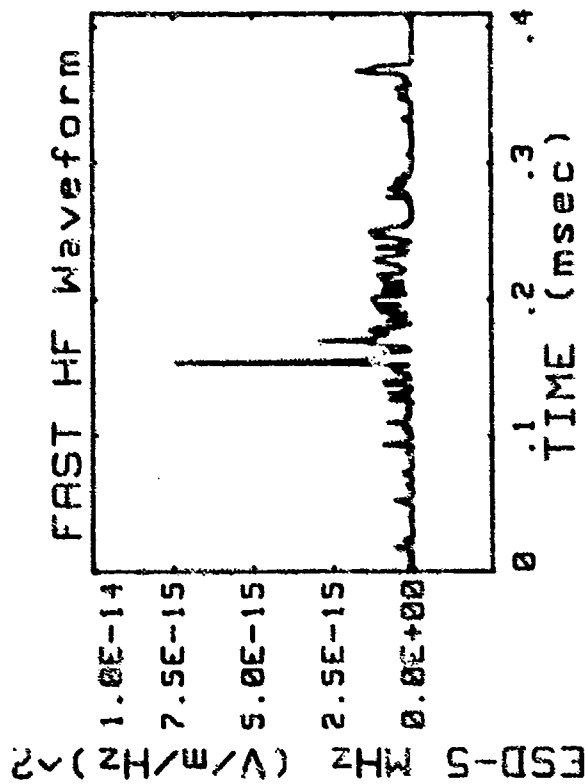
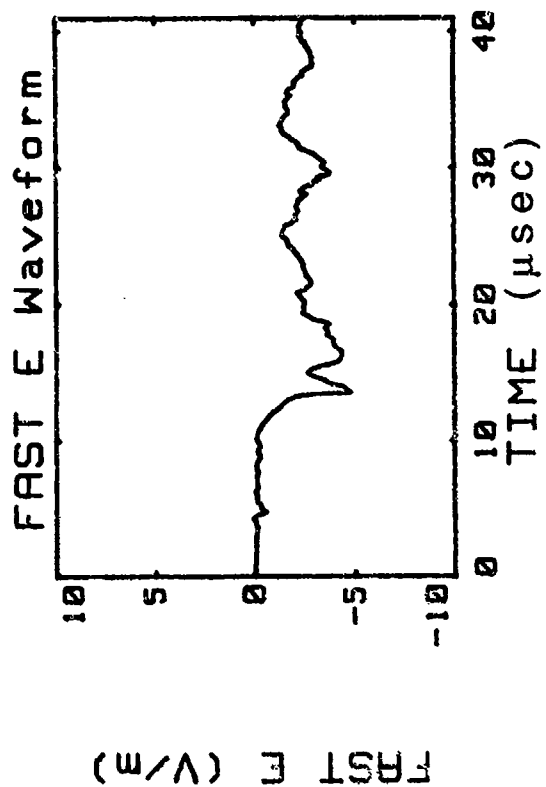
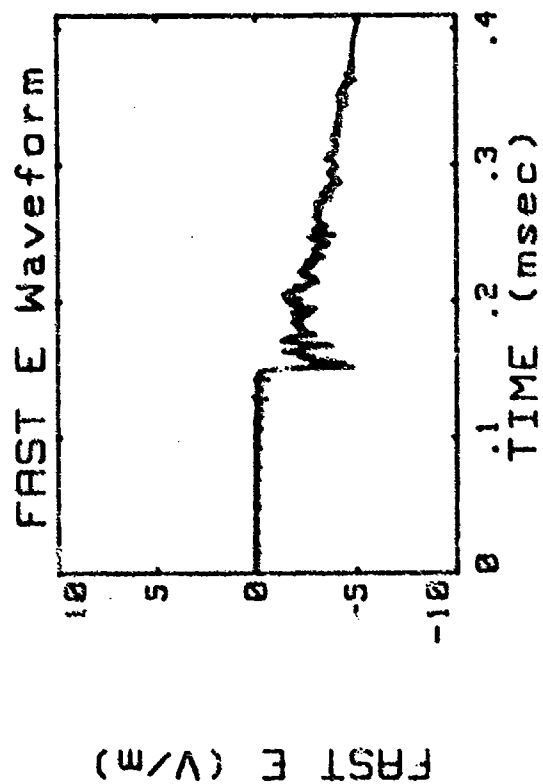


19:33:35.482 8 Aug 1985 (9.9 Km)



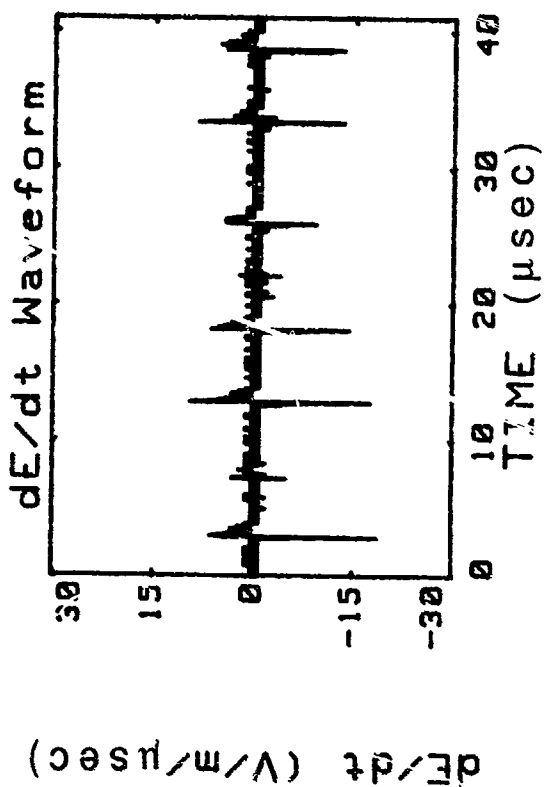
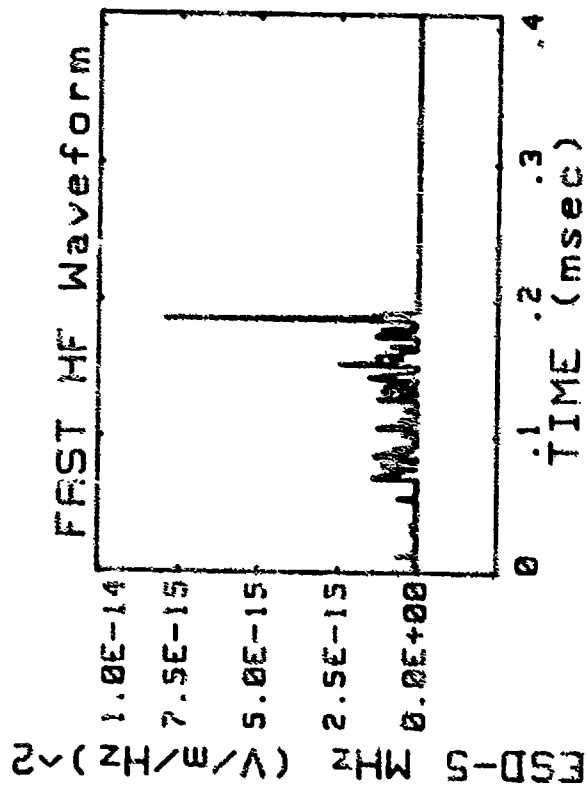
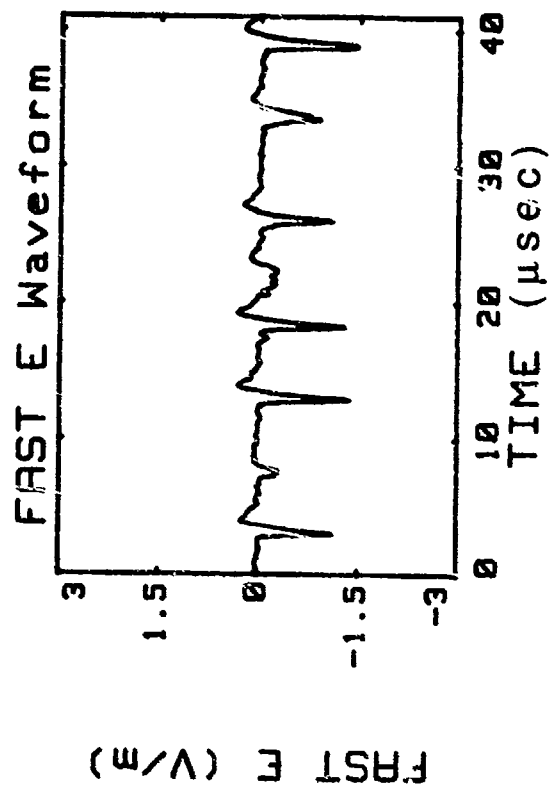
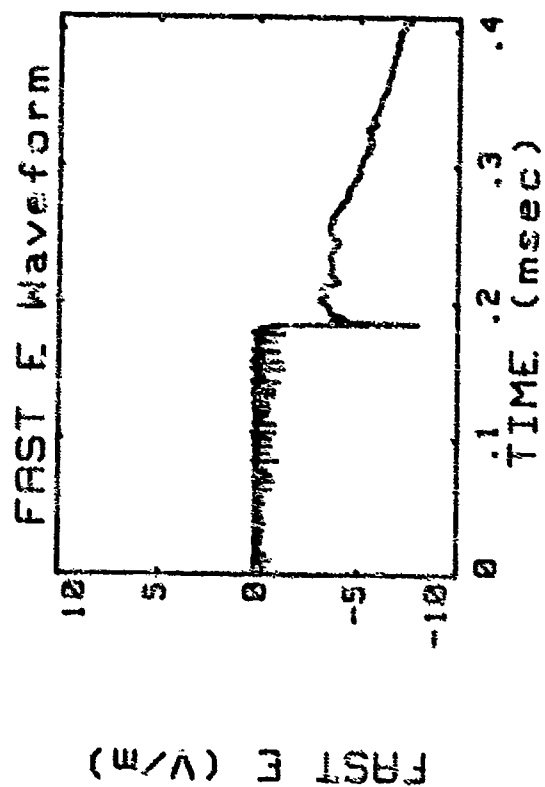
220193417.375 1985

1st RS (12 Km)

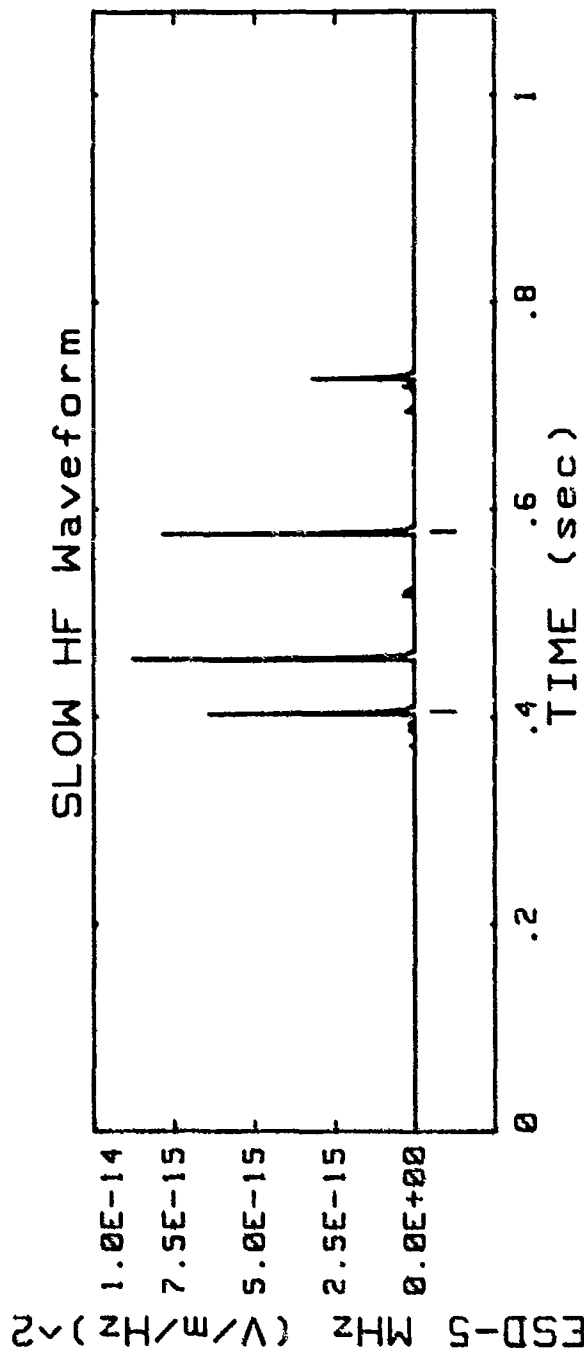
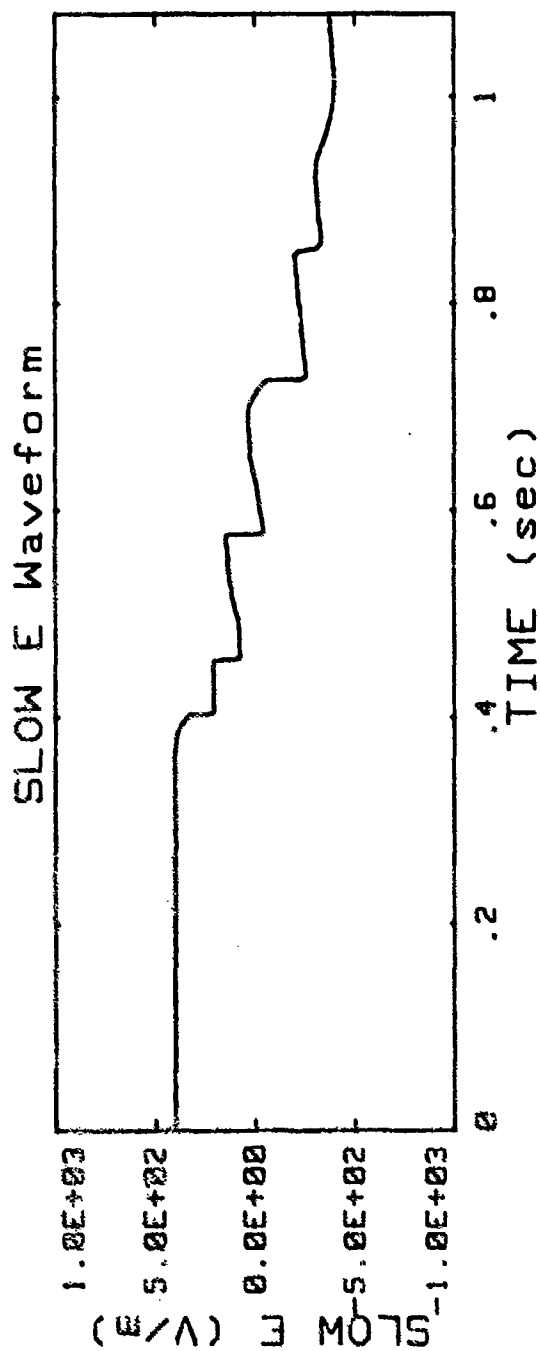


220193417.549 1985

DS Leader (12 Km)

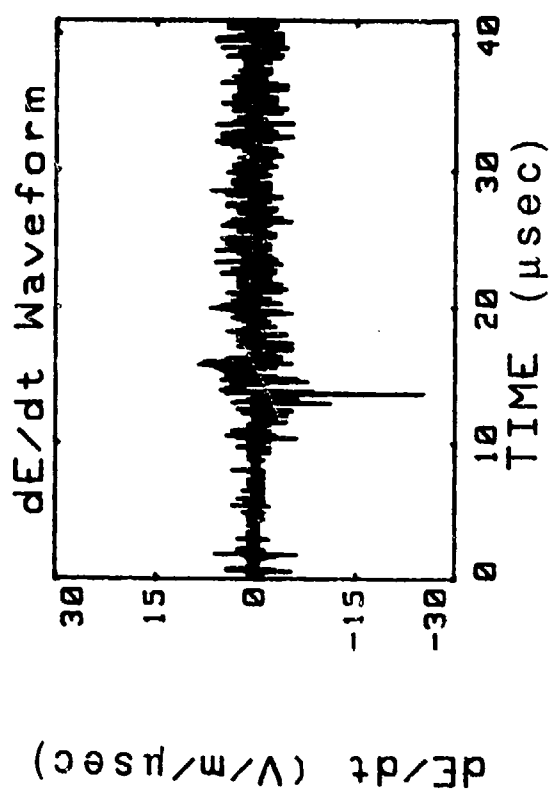
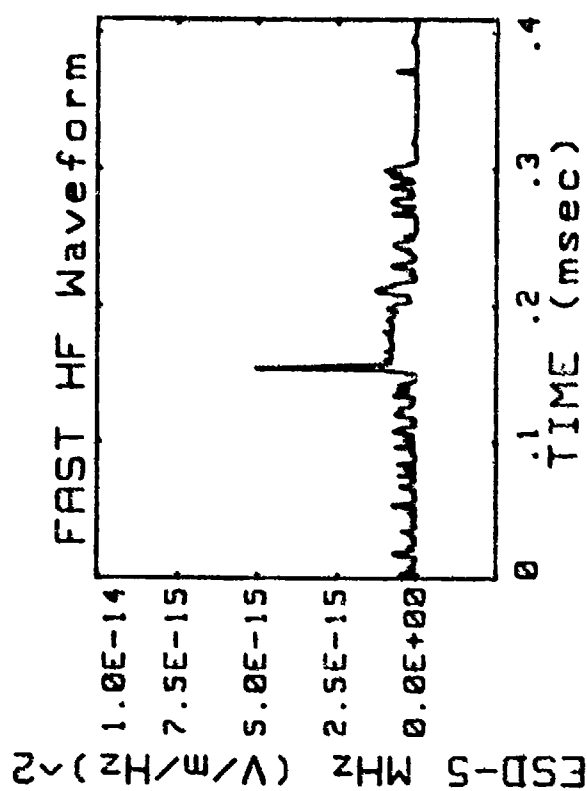
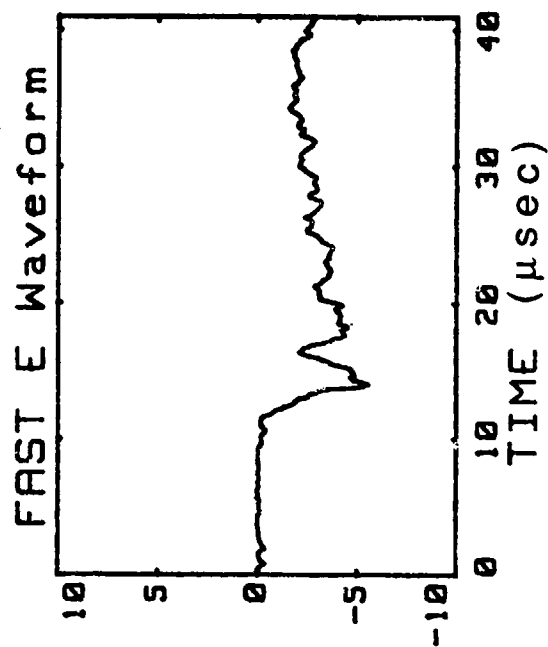
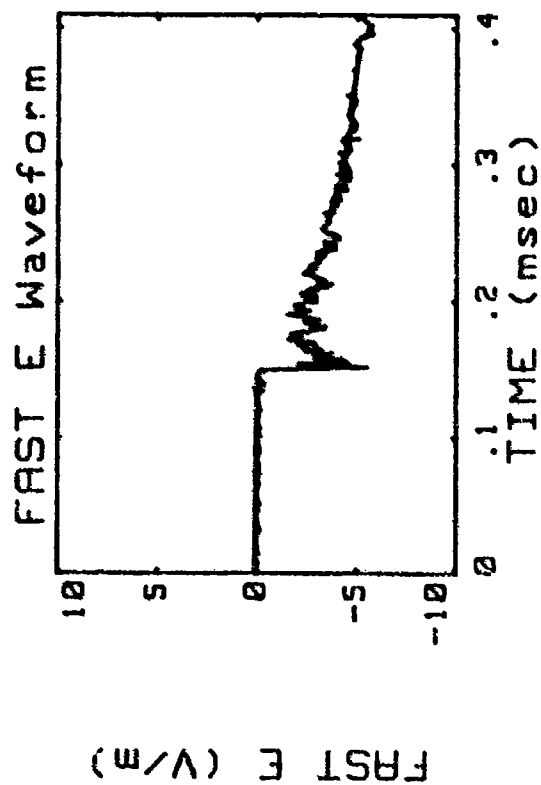


19:34:16.982 8 Aug 1985 (12 Km)



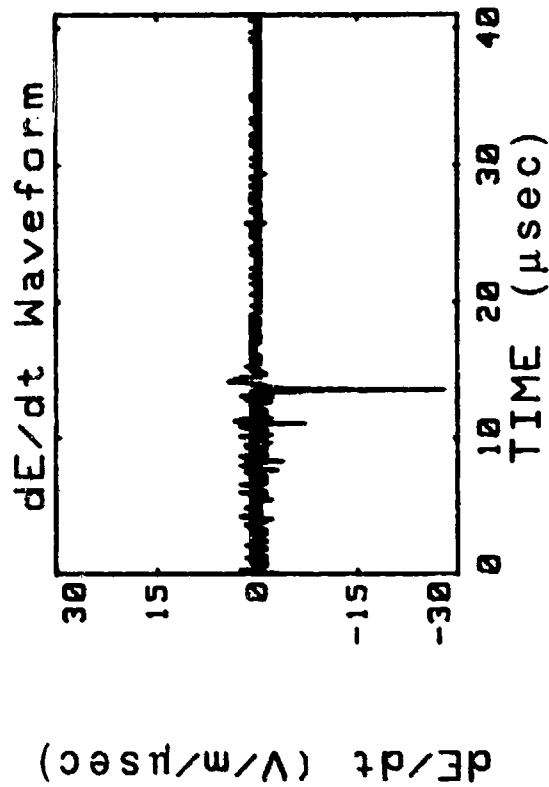
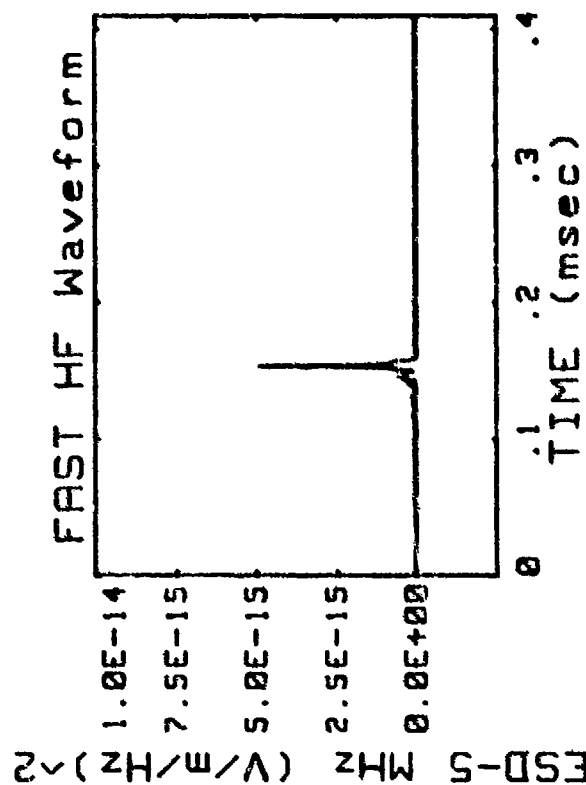
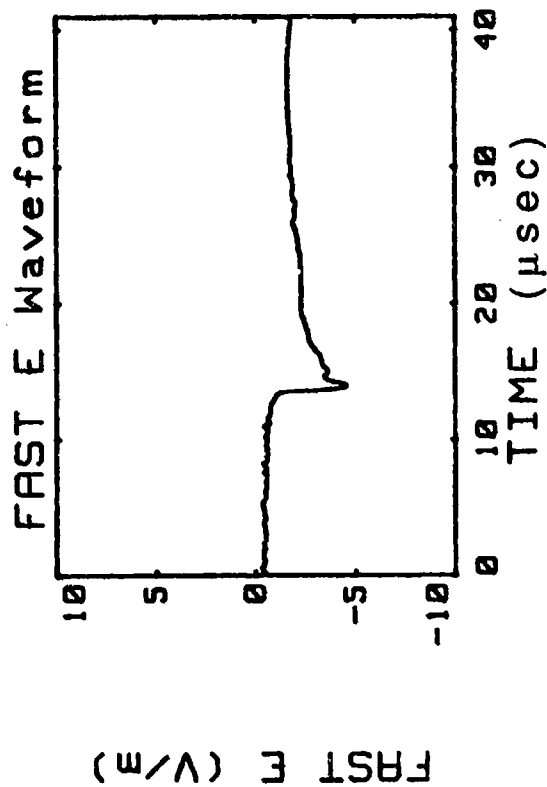
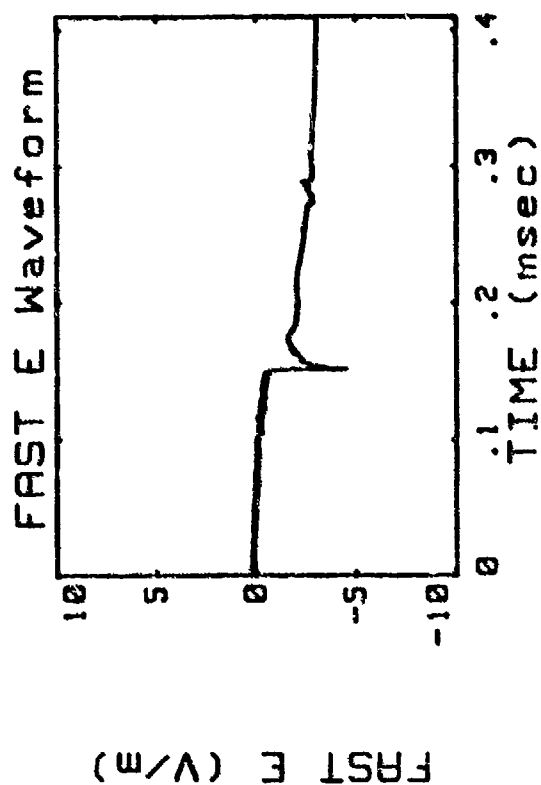
220193424.687 1985

1st RS (9.5 Km)

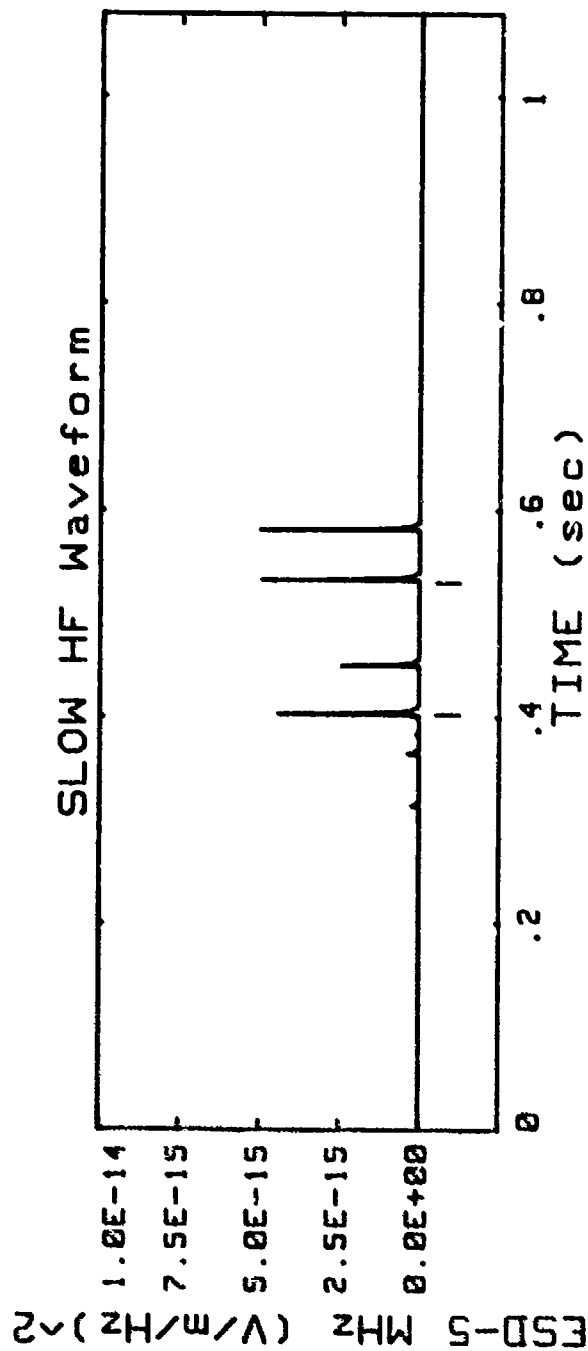
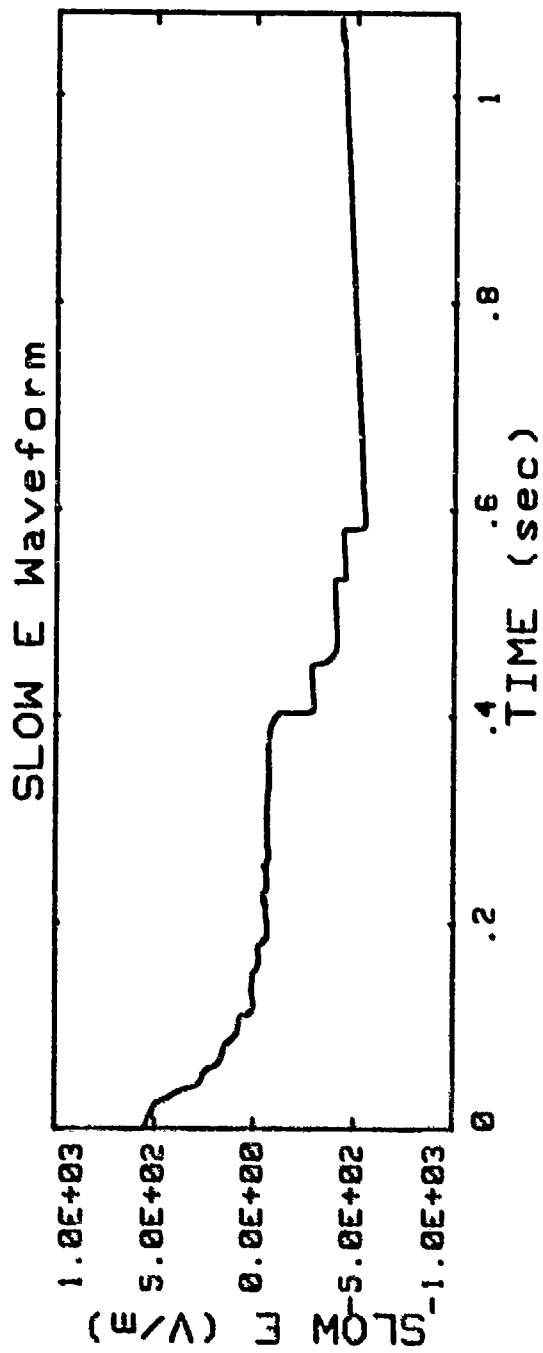


220193424.015 1985

Norm Subs RS (9.5 Km)

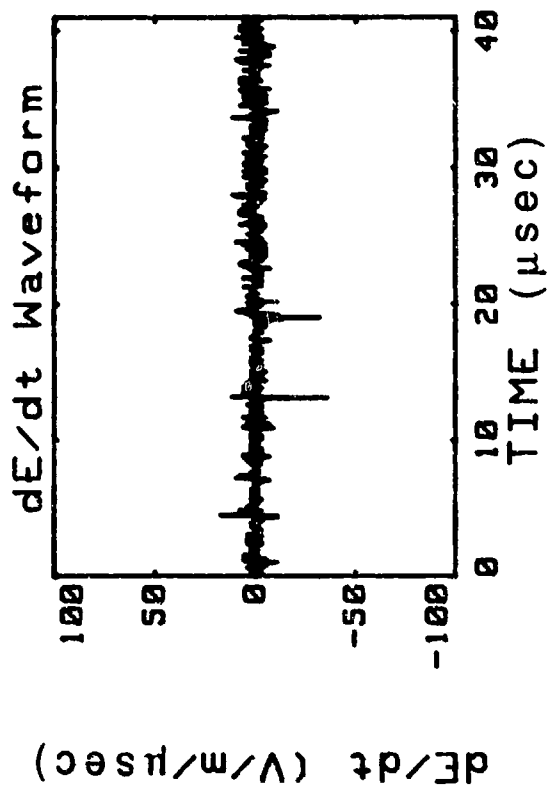
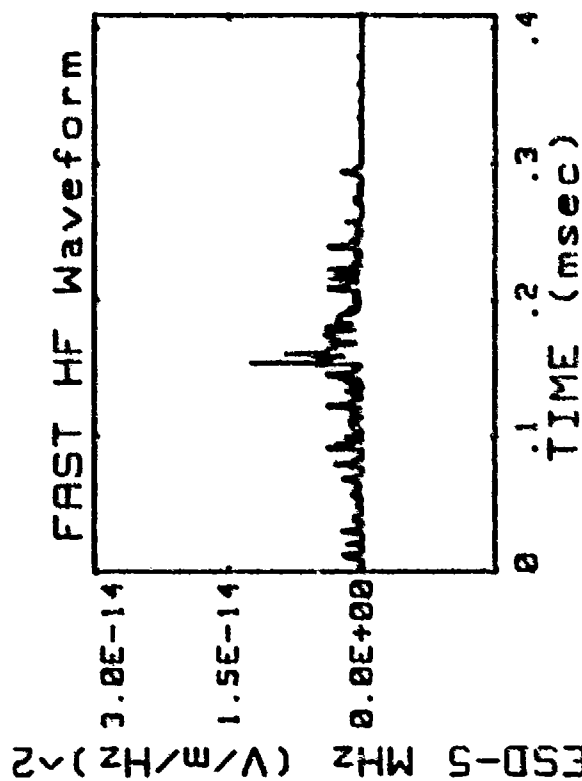
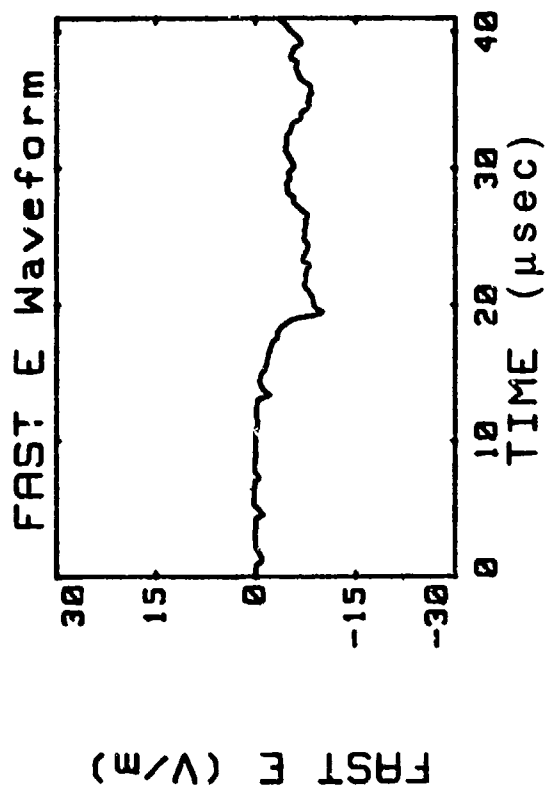
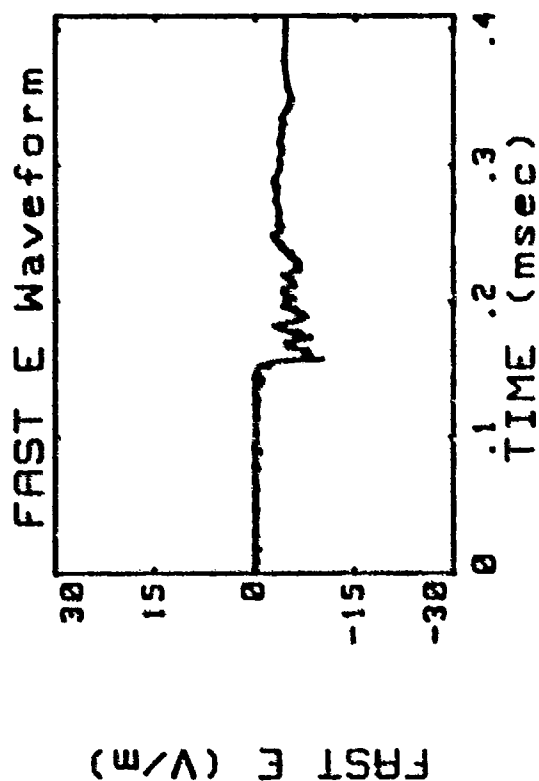


19:34:24.297 8 Aug 1985 (9.5 Km)

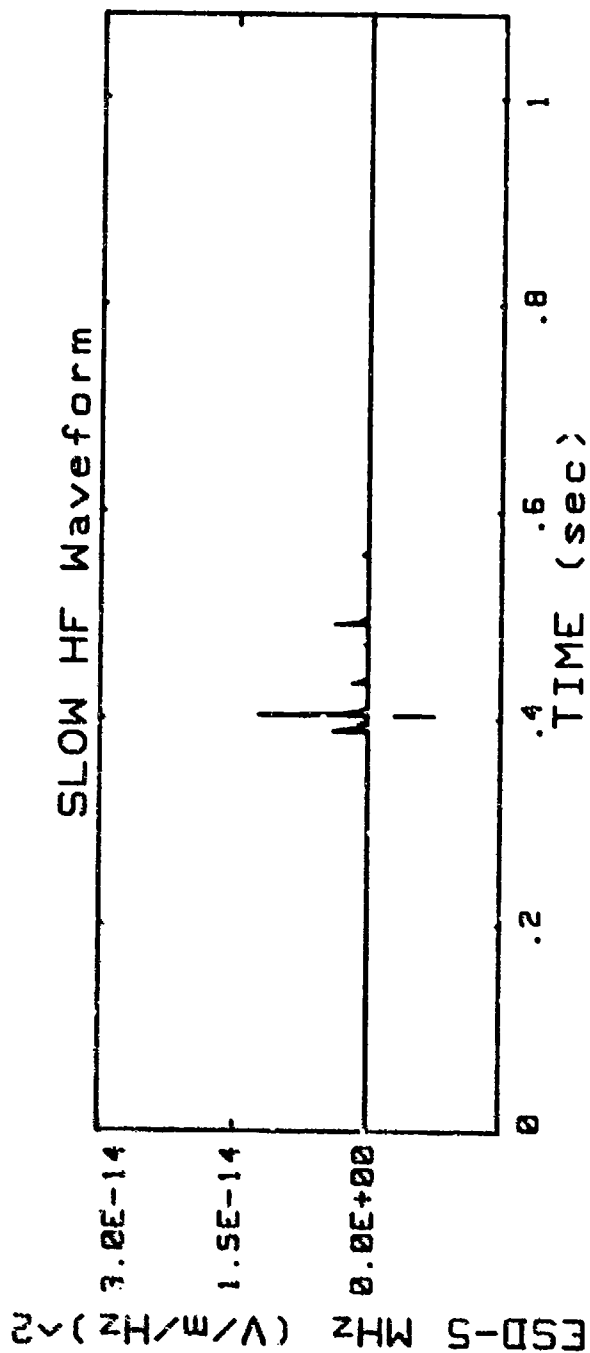
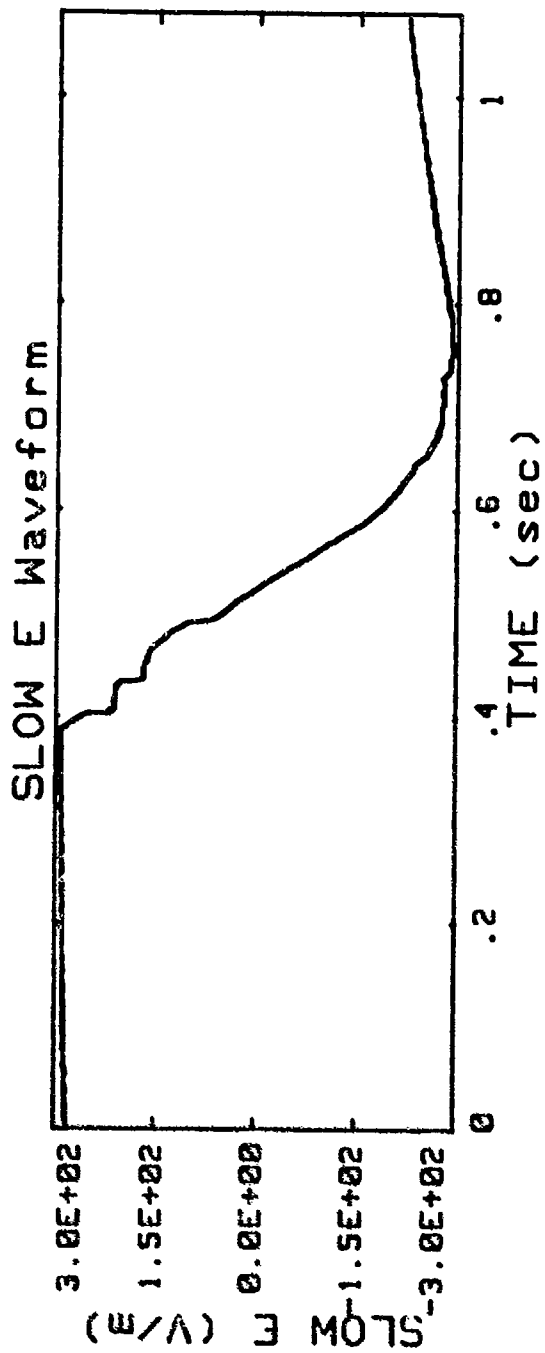


220193433.065 1985

1st RS (22 Km)

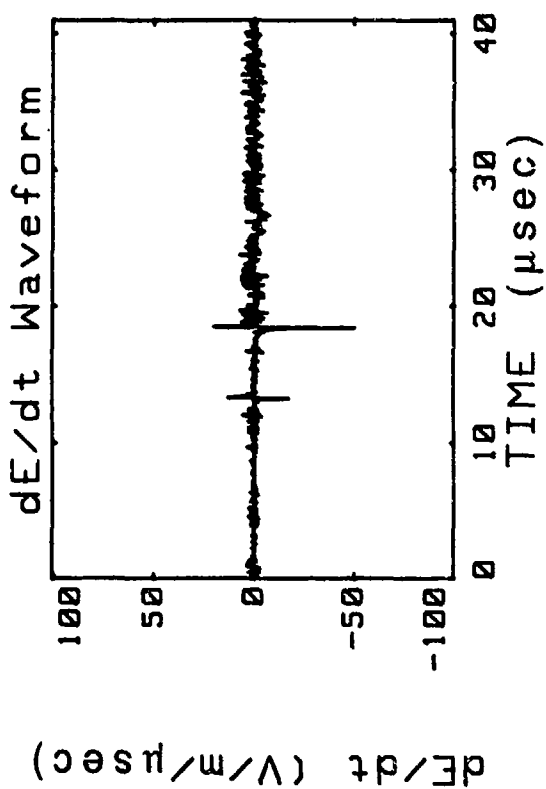
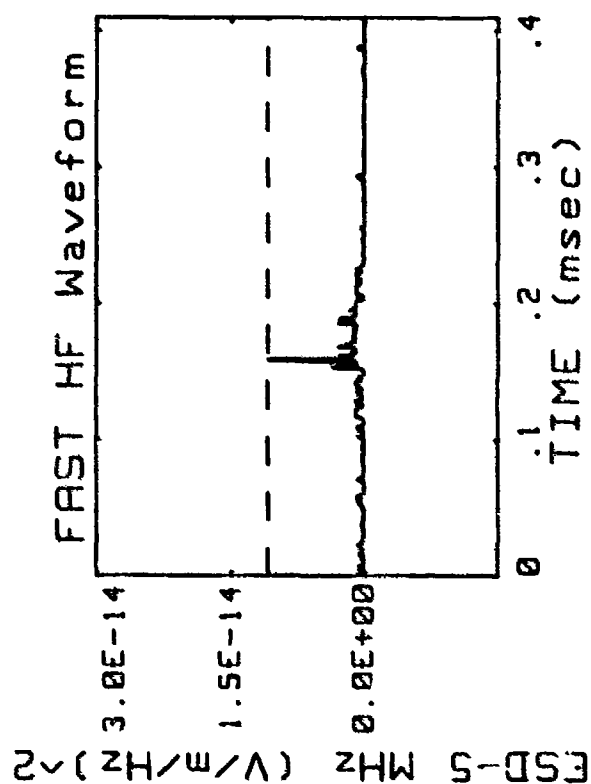
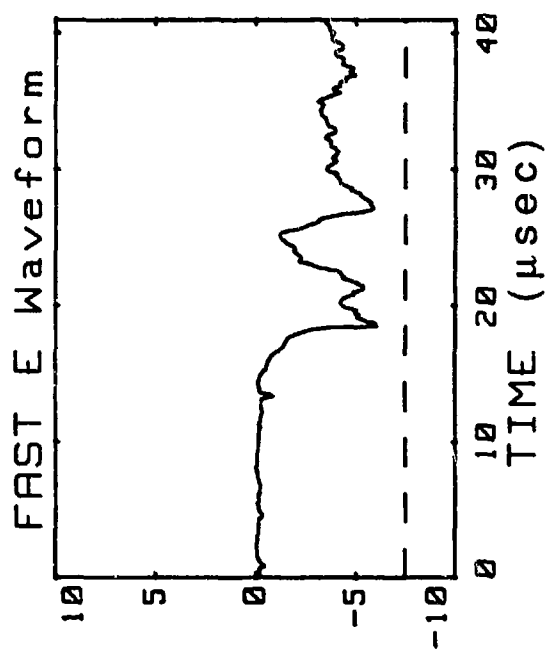
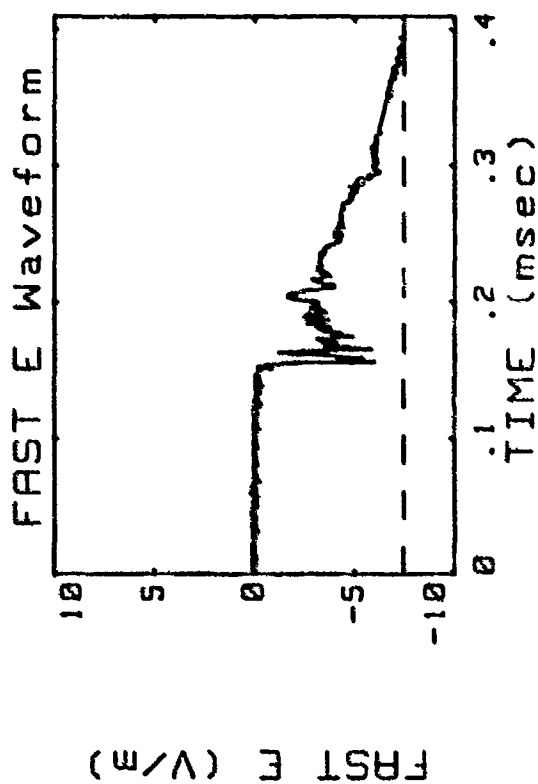


19:34:32.675 8 Aug 1985 (22 Km)



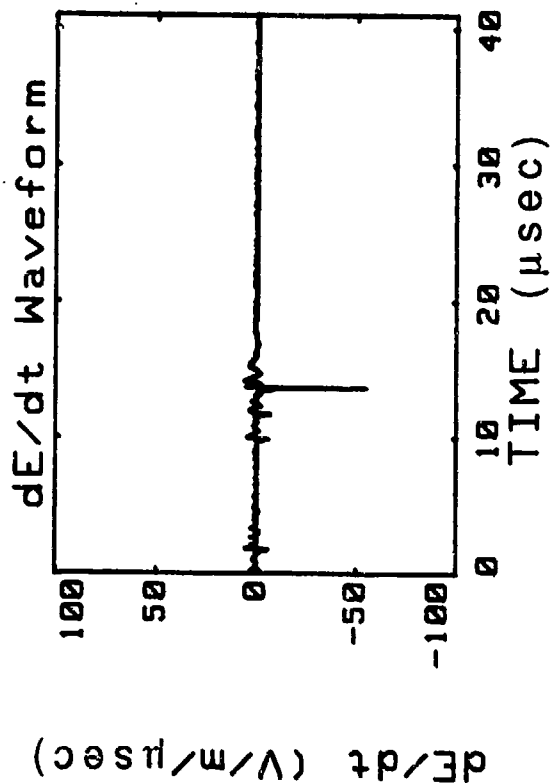
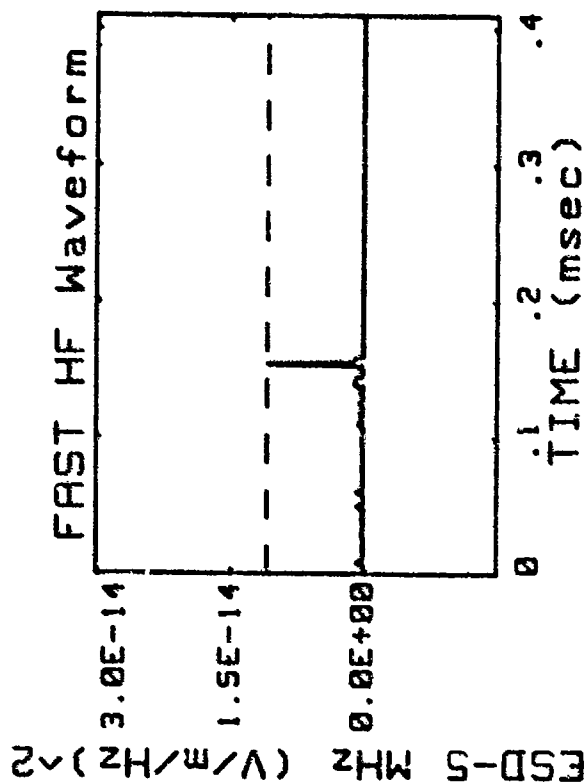
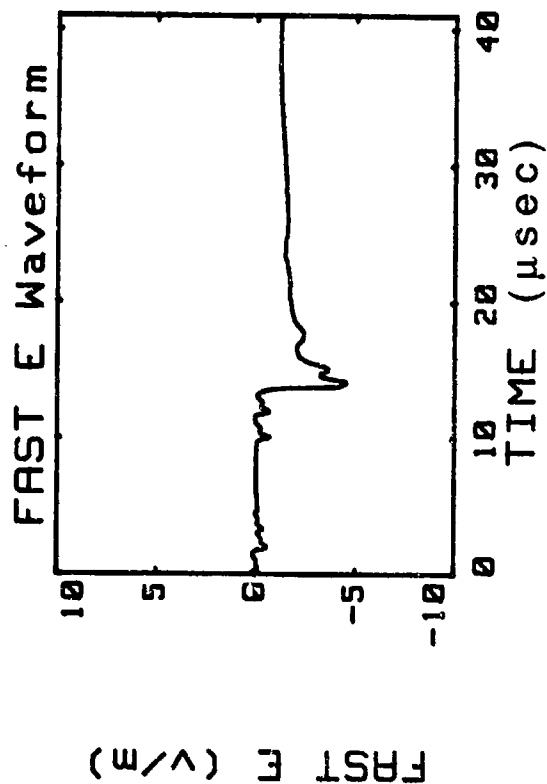
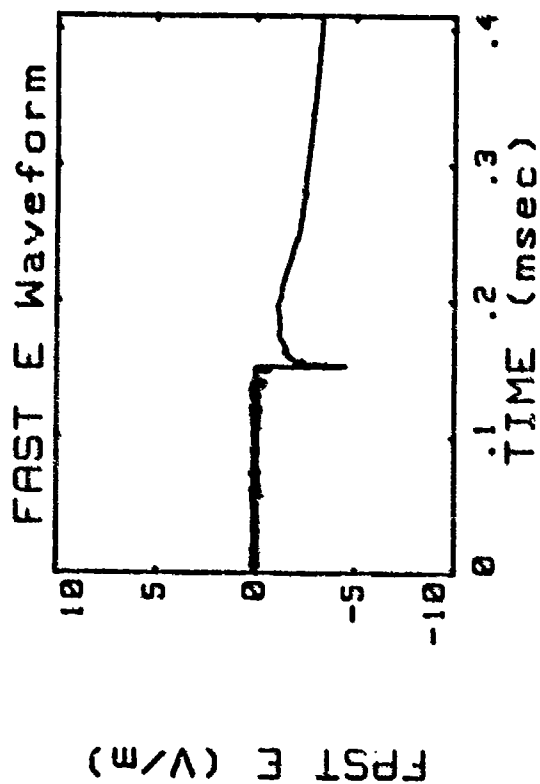
220193443.006 1985

1st RS (10.4 Km)



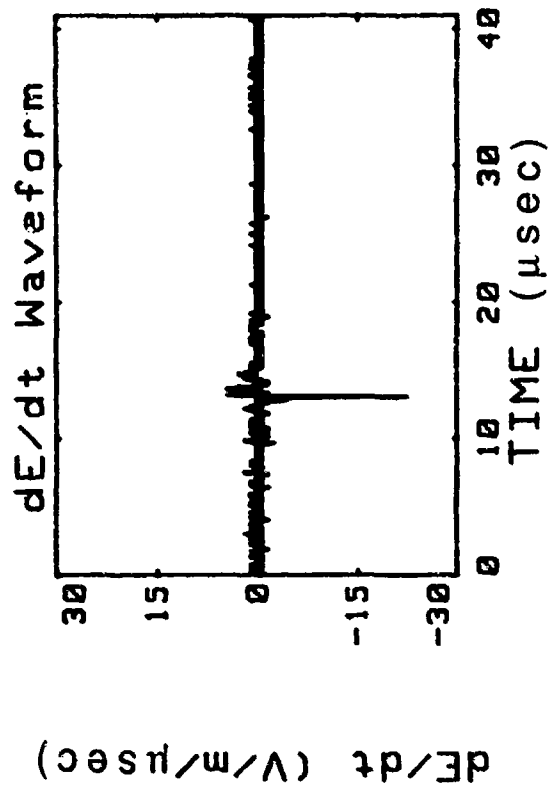
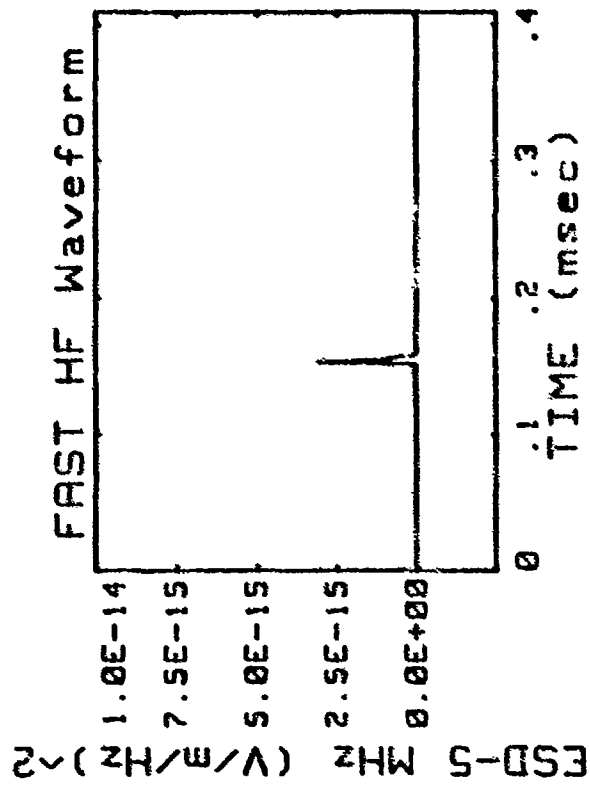
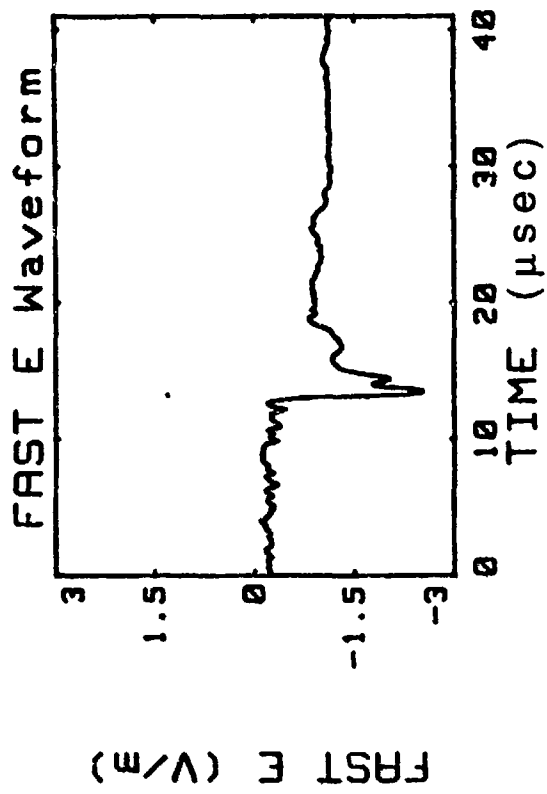
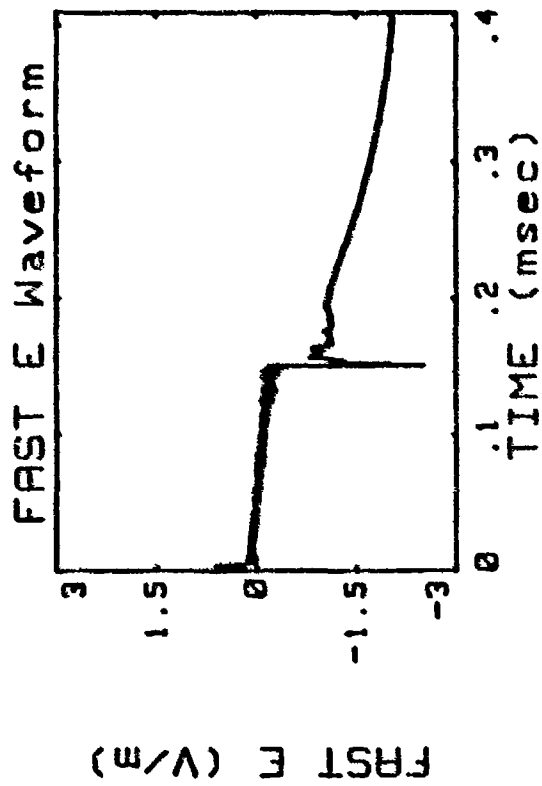
220193443.151 1985

DS Subs RS (10.4 Km)



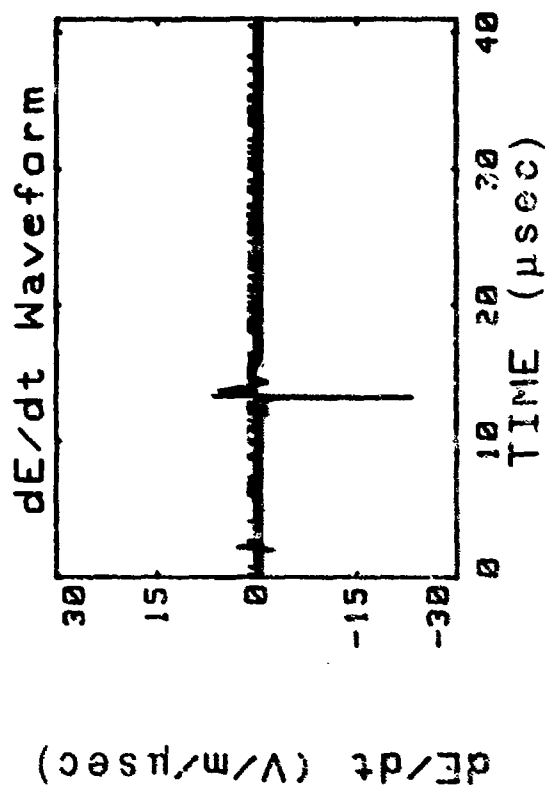
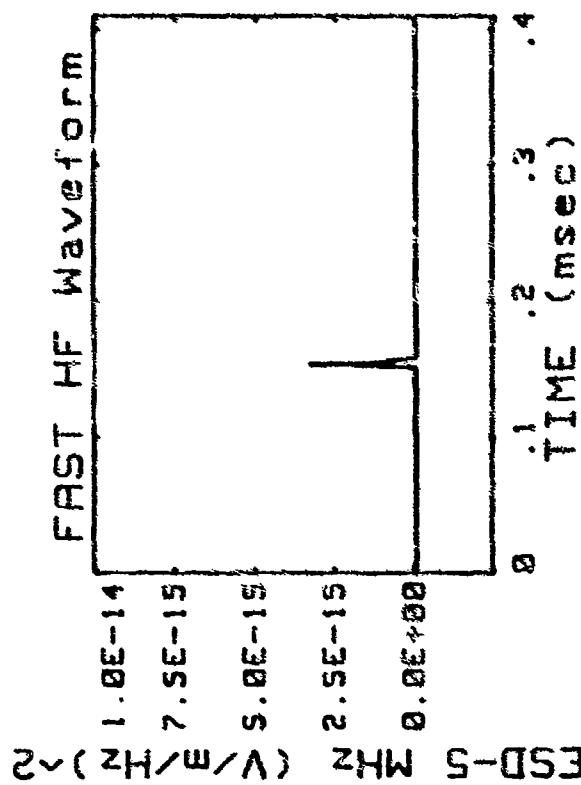
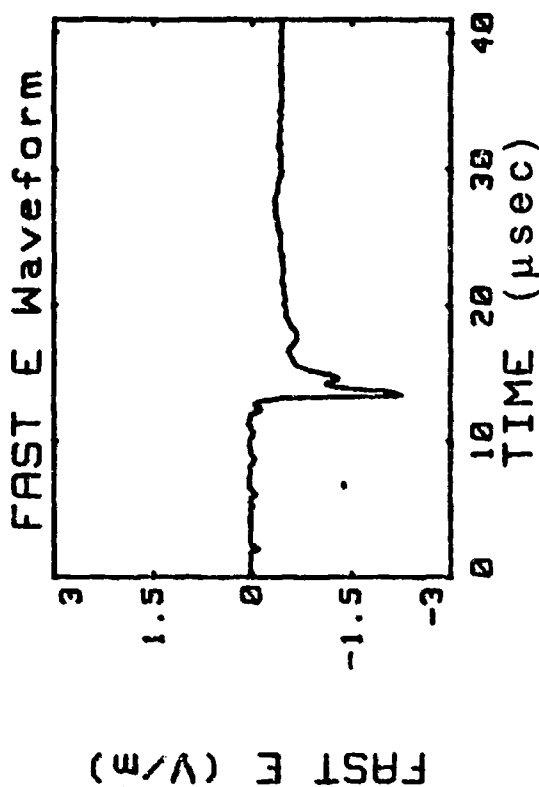
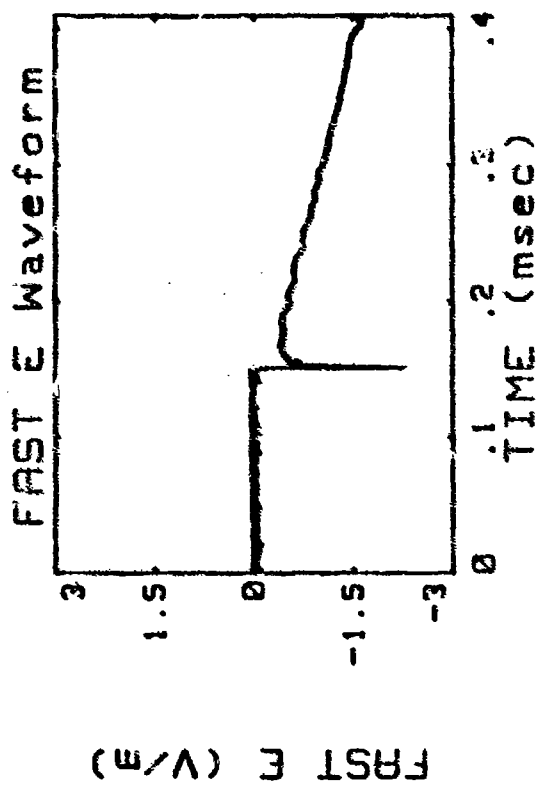
220193443.252 1985

Chaotic Subs RS (10.4 Km)

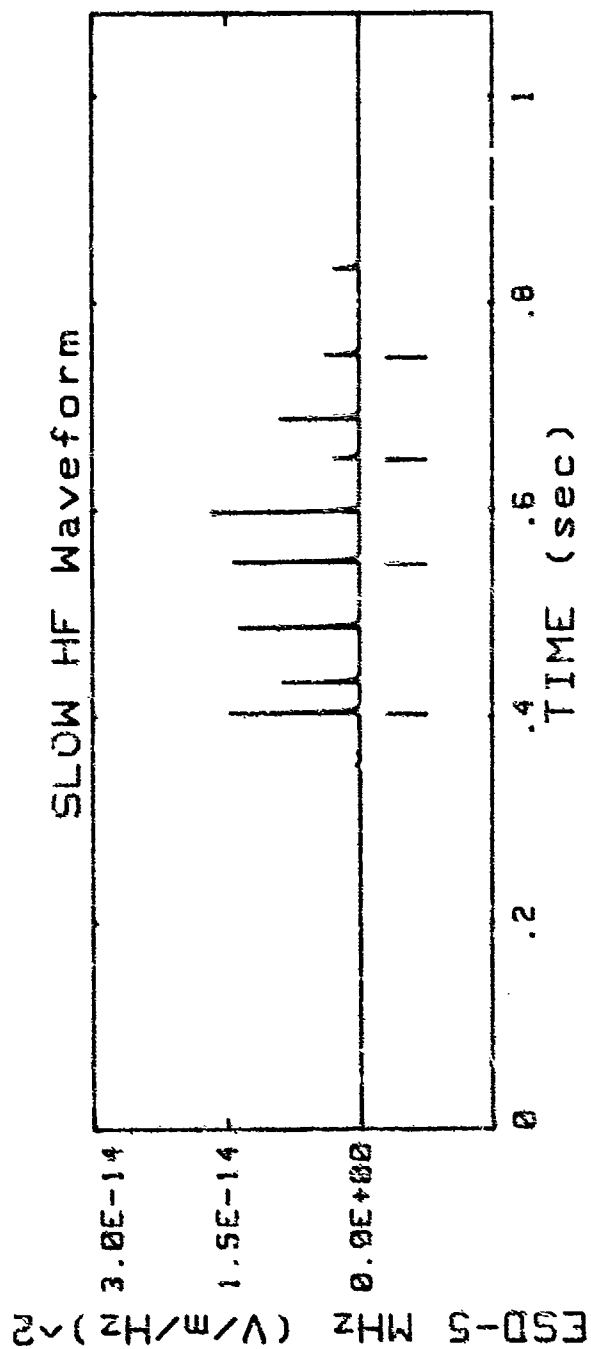
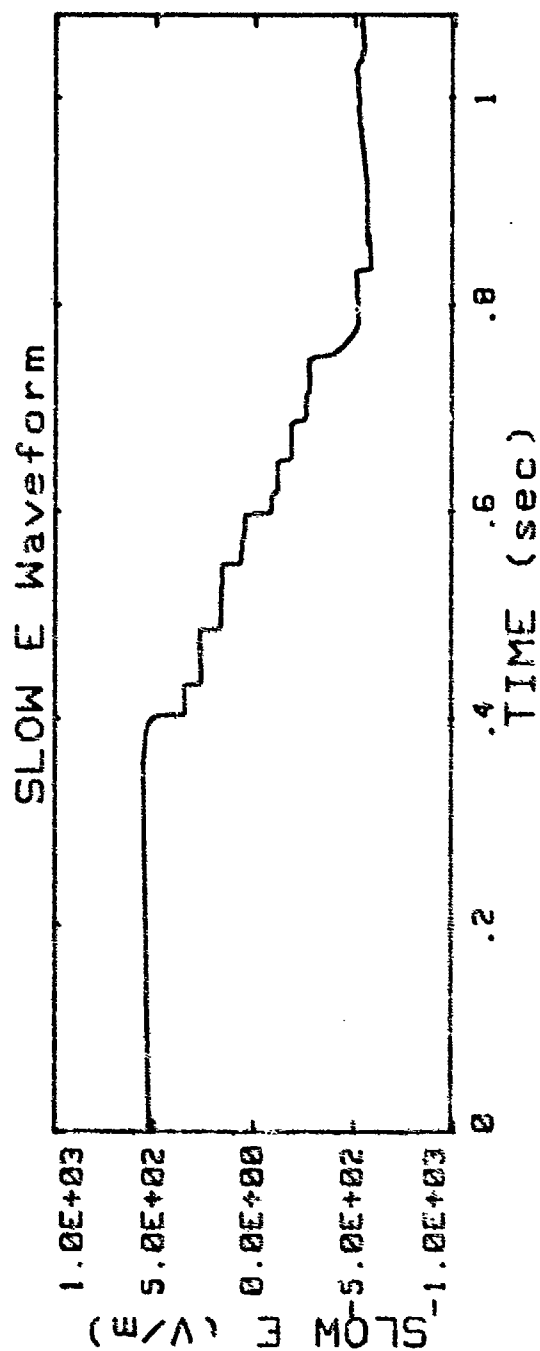


220193443.351 1385

DS Subs RS (10.4 Km)

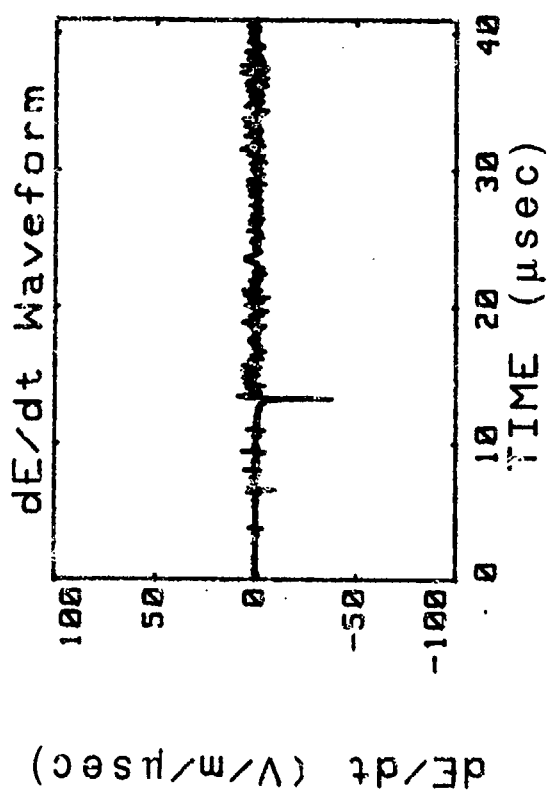
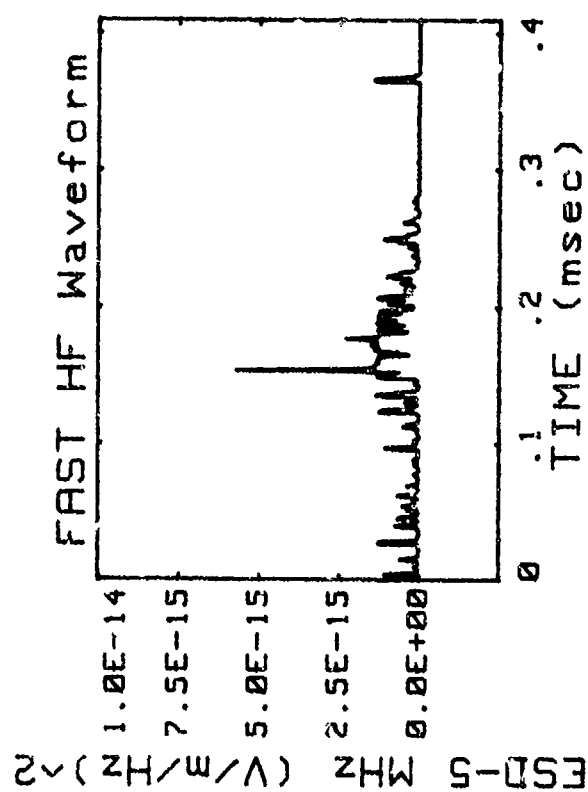
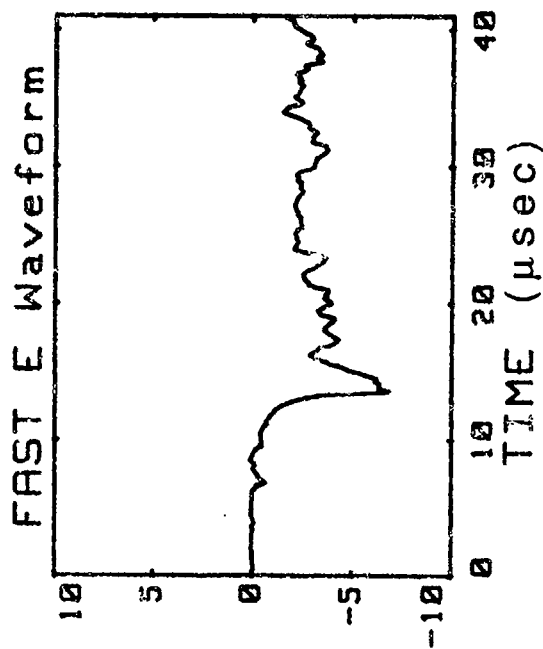
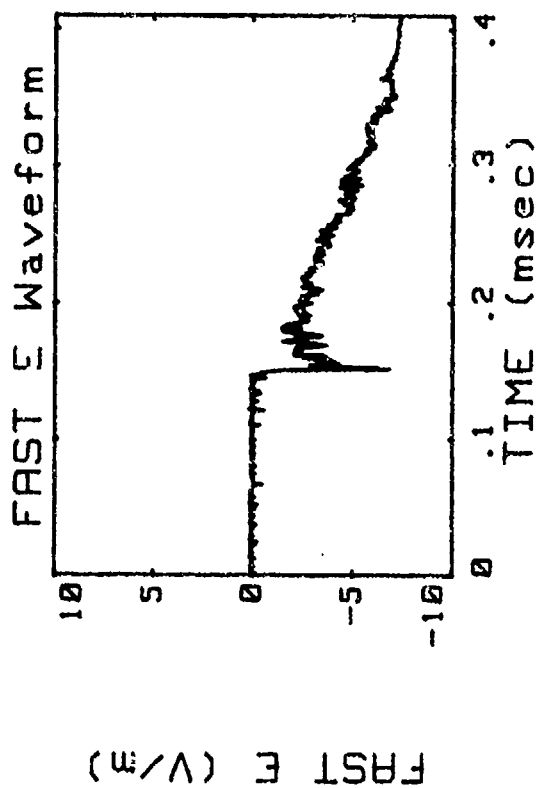


19:34:42.616 8 Aug 1985 (10.4 Km)

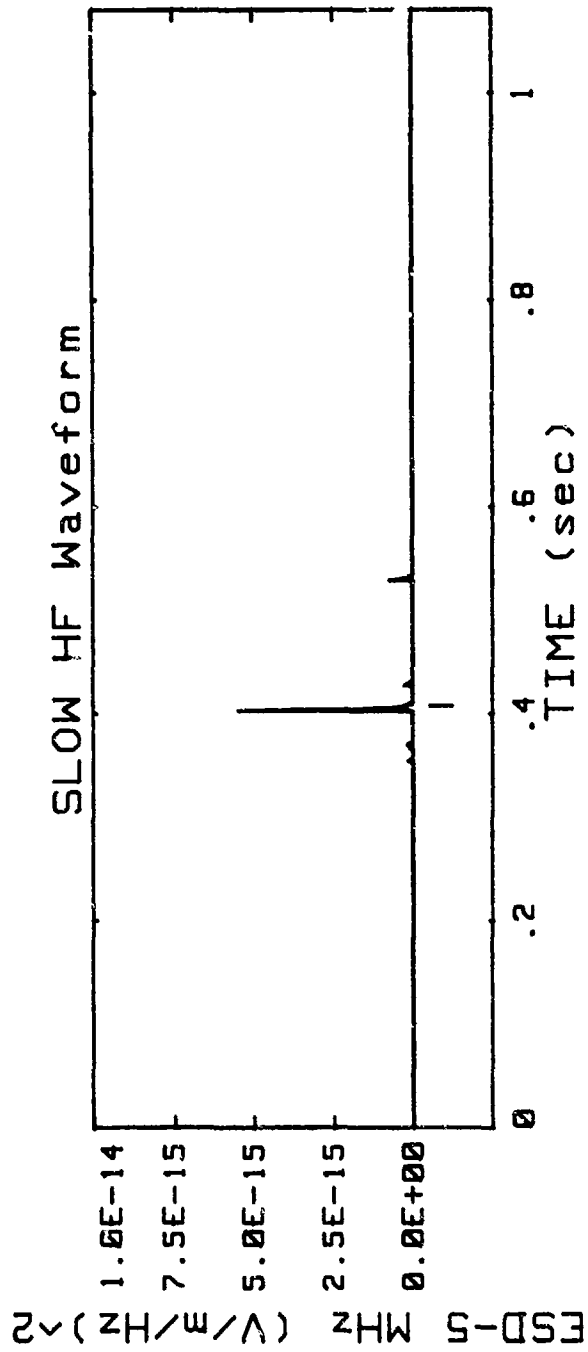
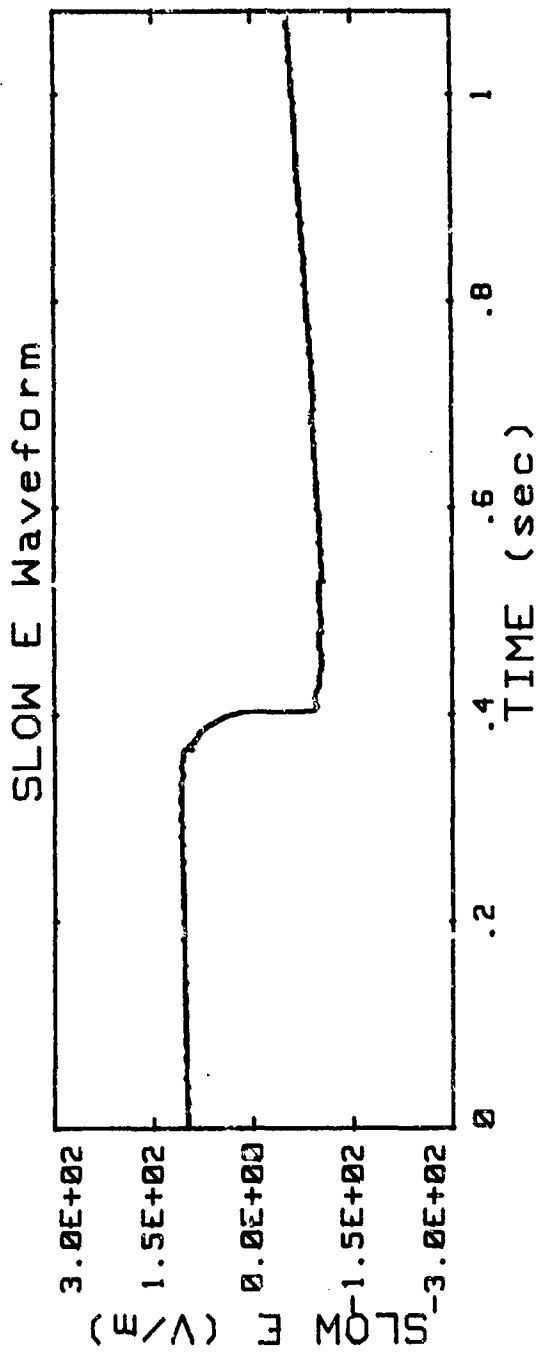


220193452.130 1985

1st RS (12.5 Km)

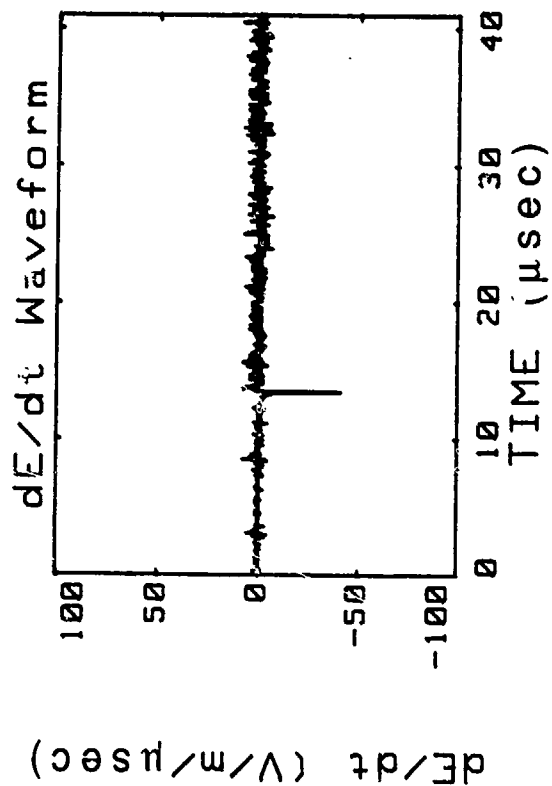
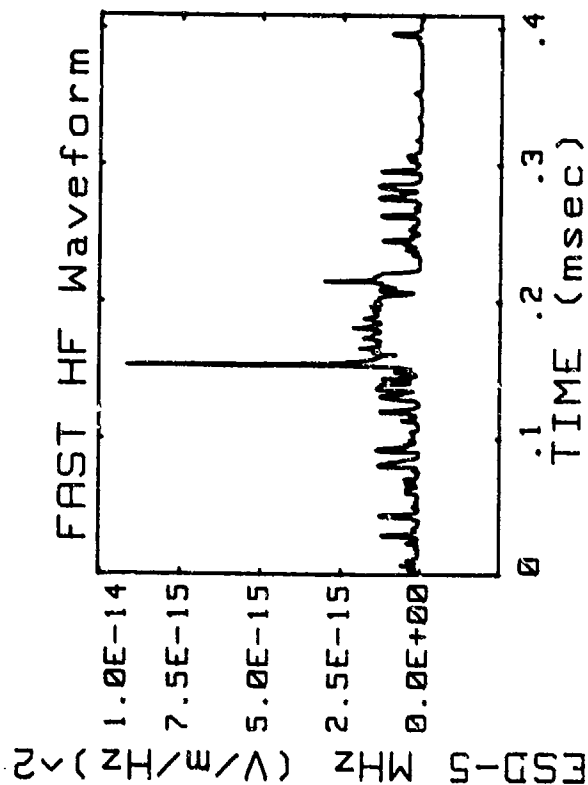
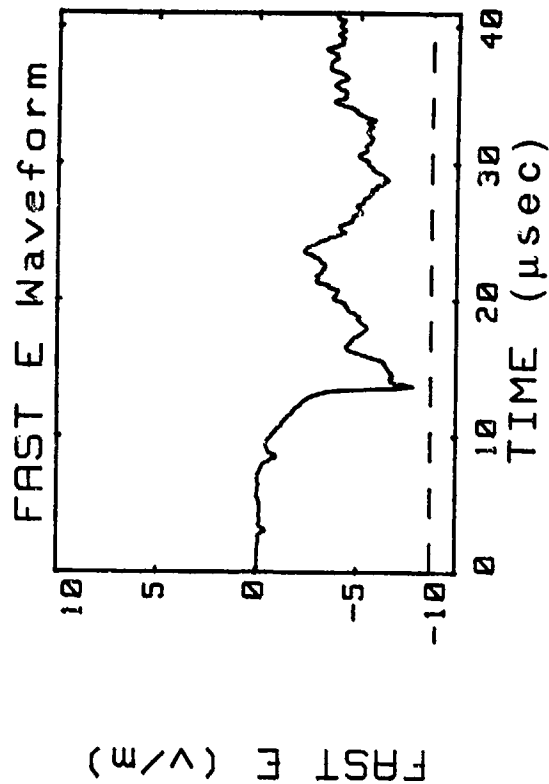
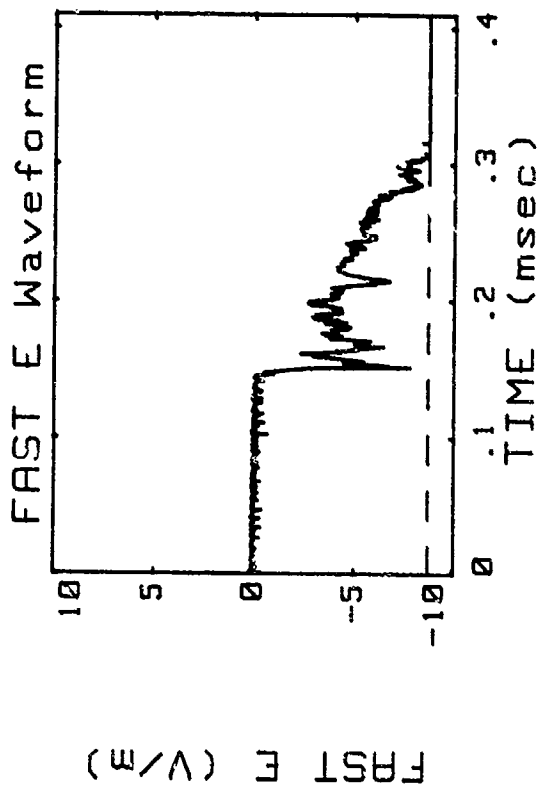


19:34:51.735 8 Aug 1985 (12.5 Km)



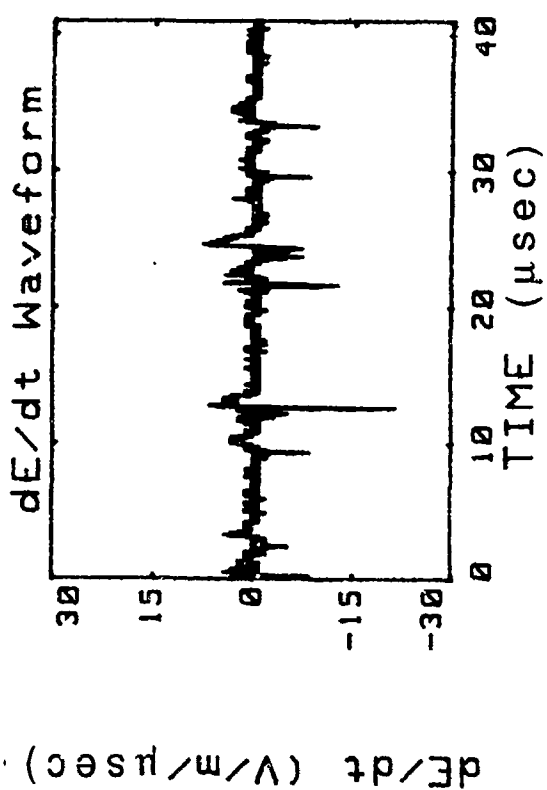
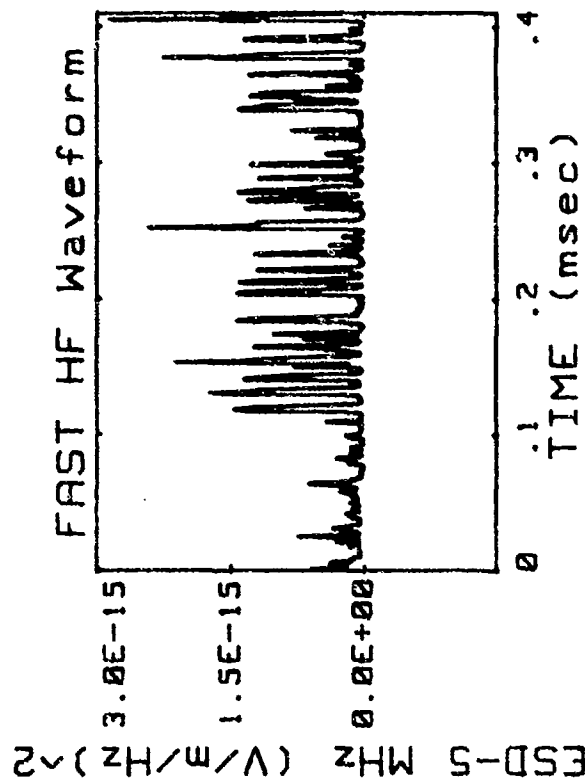
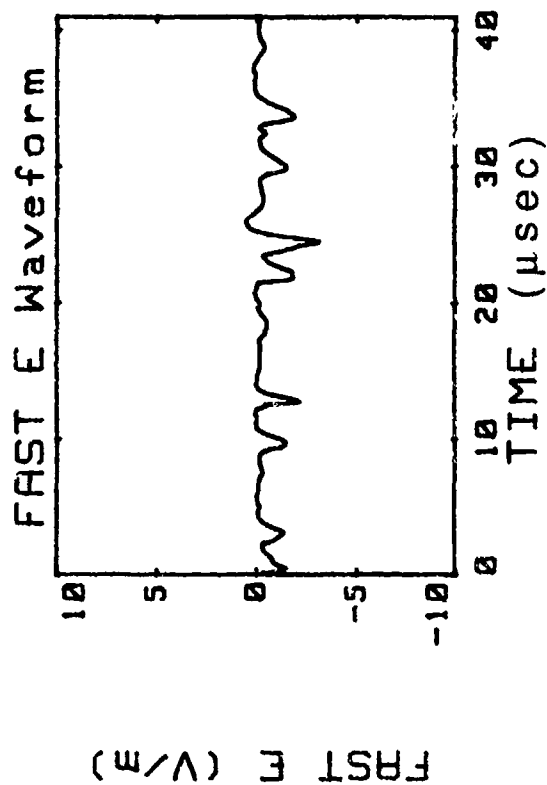
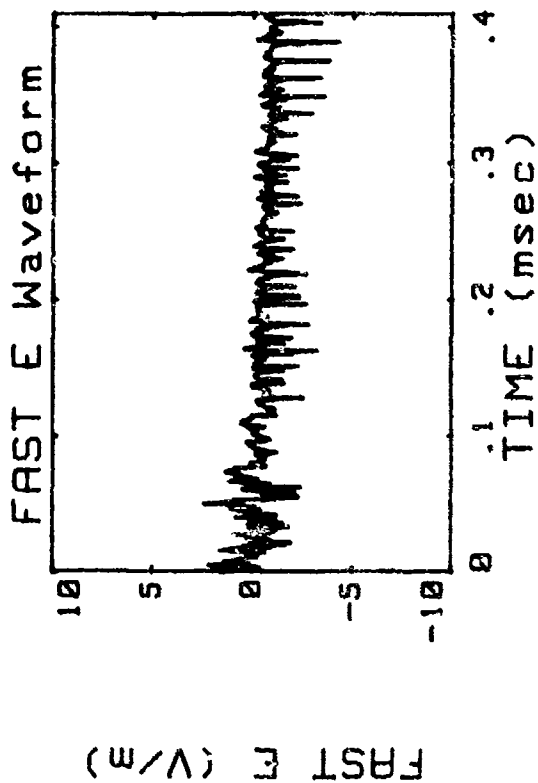
220193459.940 1985

1st RS (12.4 Km)

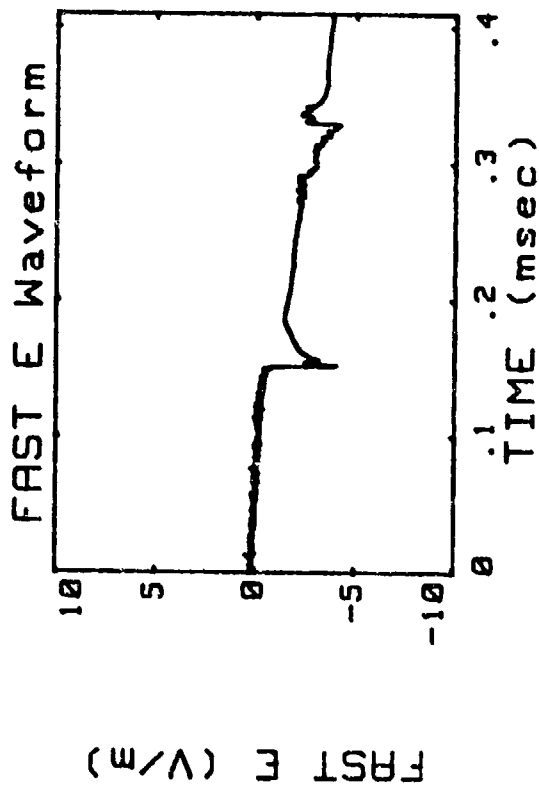


220193500.052 1985

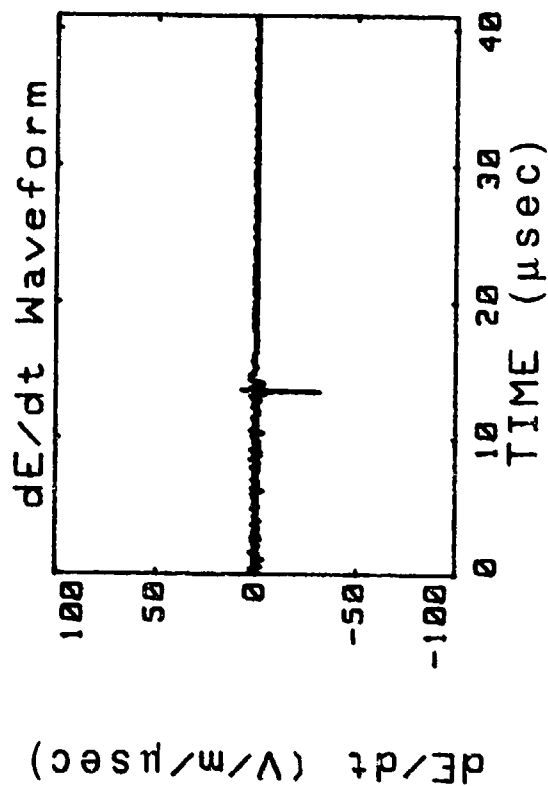
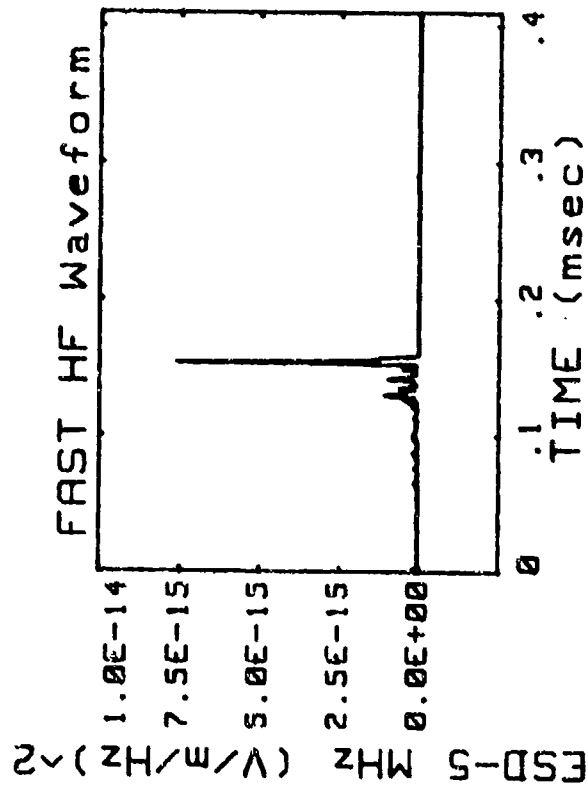
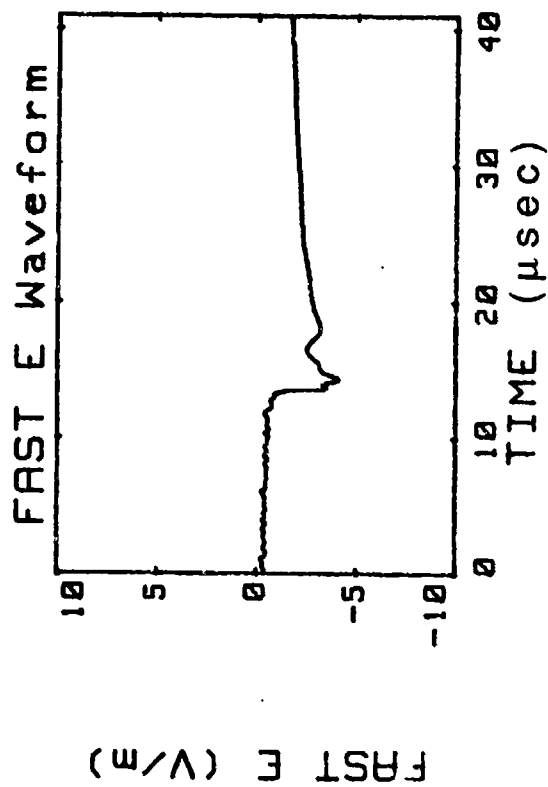
DS Leader (12.4 Km)



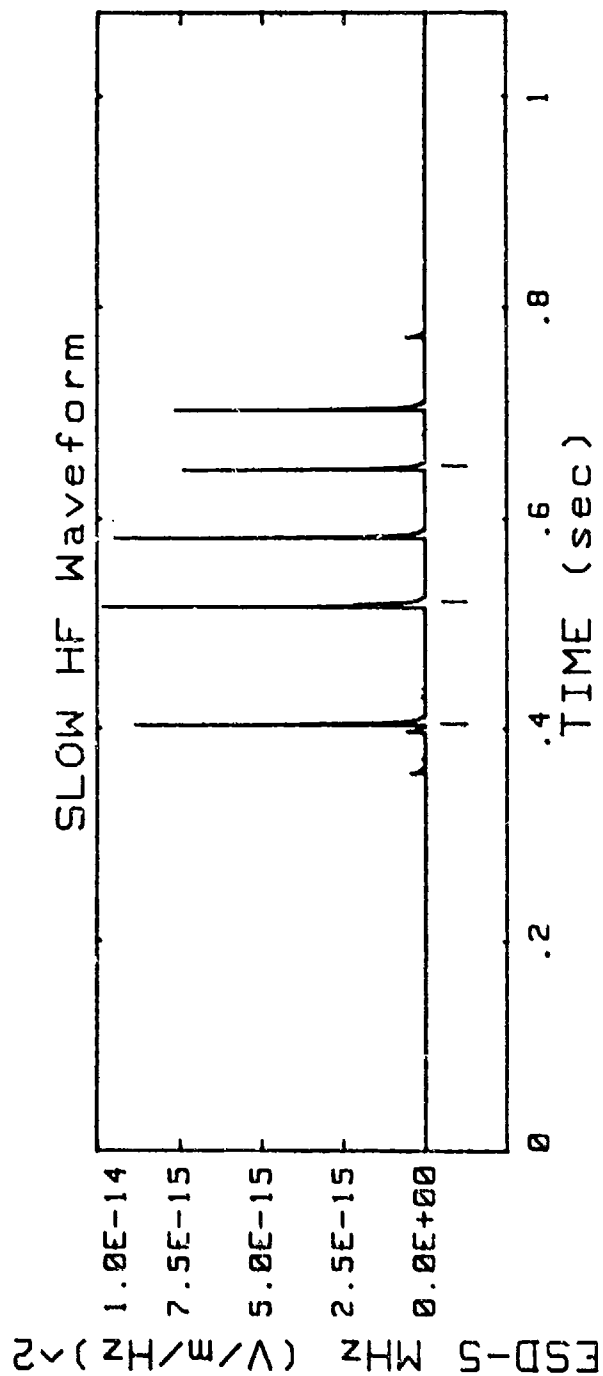
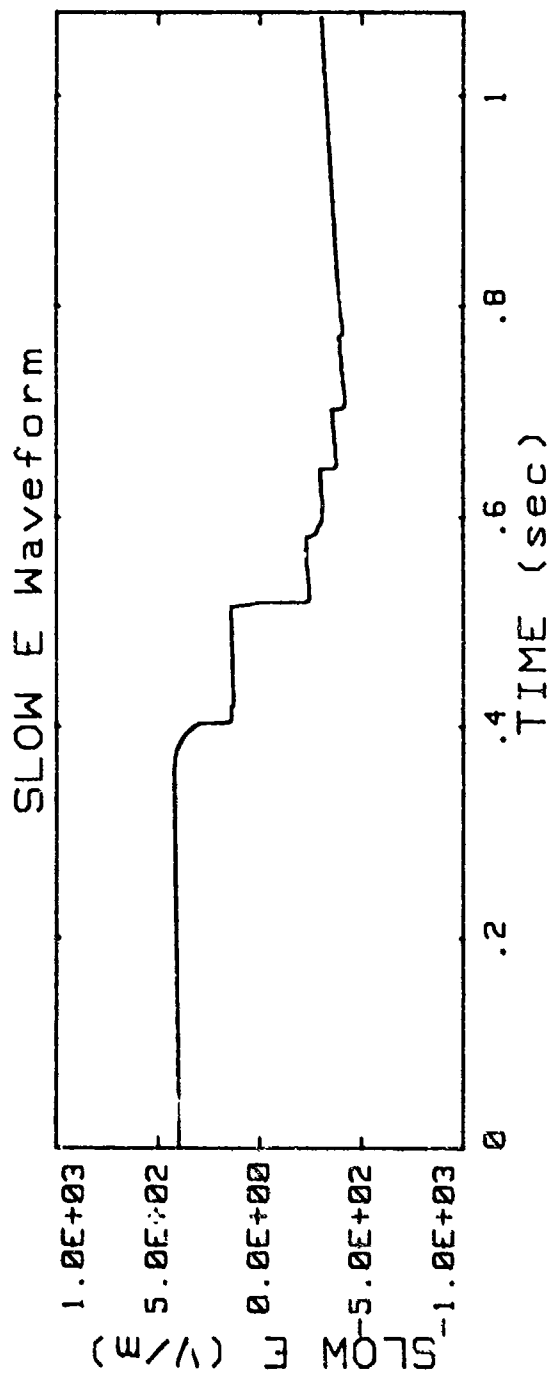
220193500.182 1985



Chaotic Subs RS (12.4 Km)

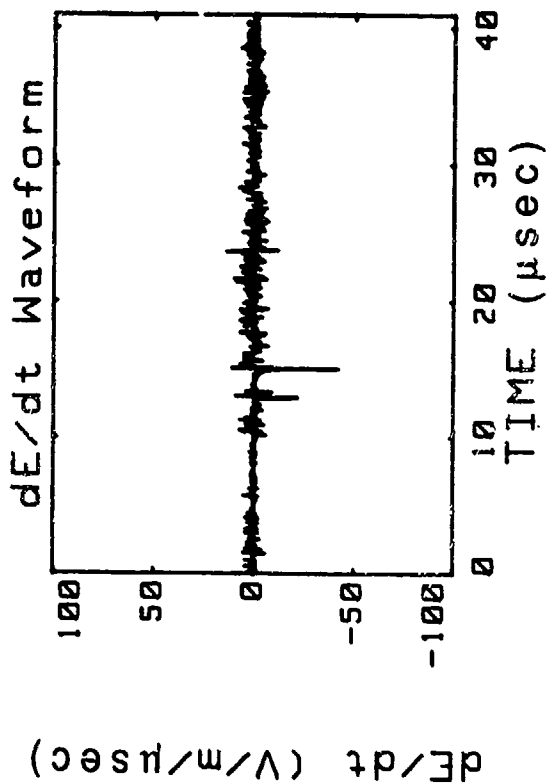
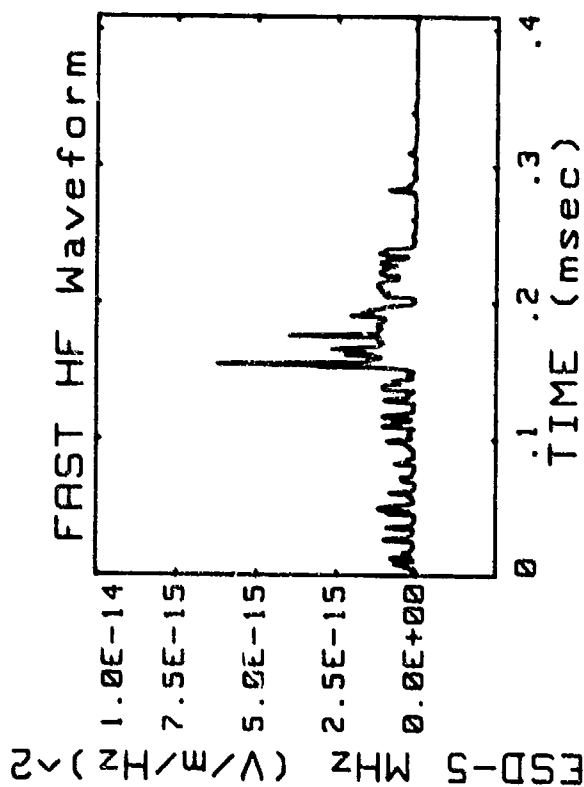
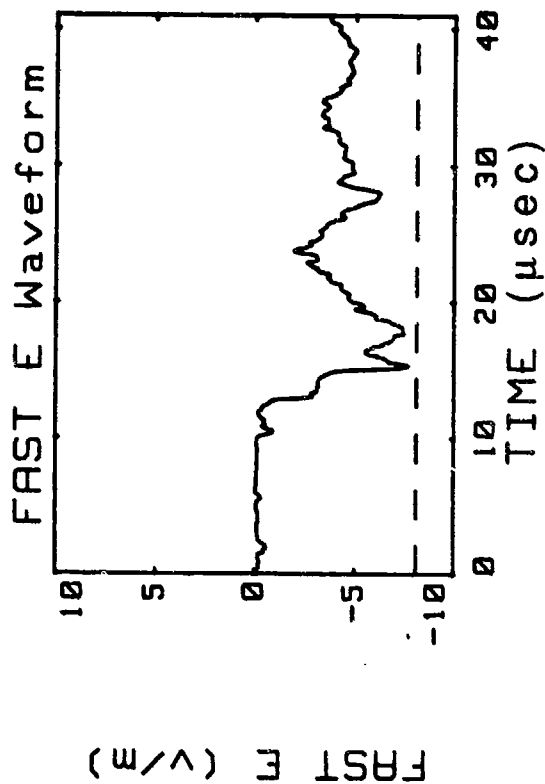
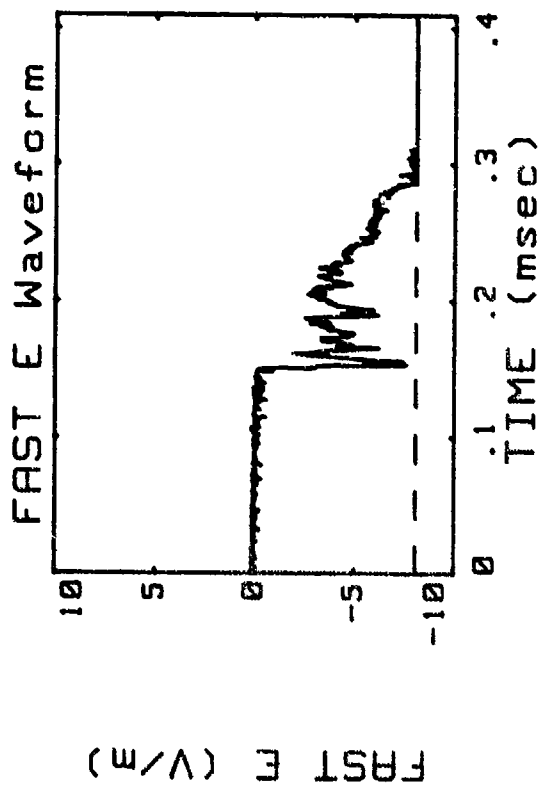


19:34:59.544 8 Aug 1985 (12.4 Km)



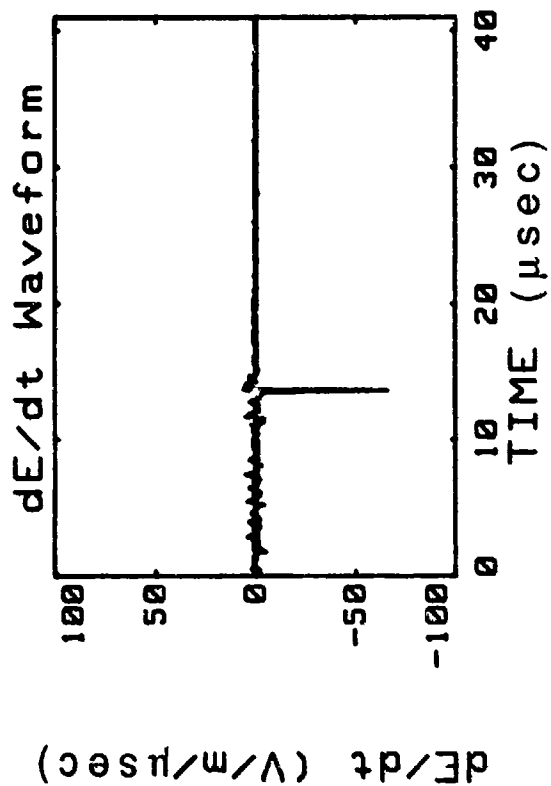
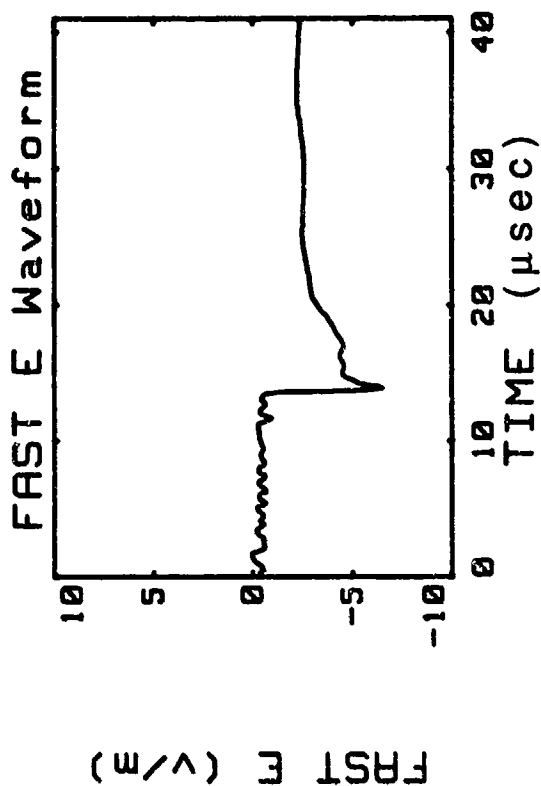
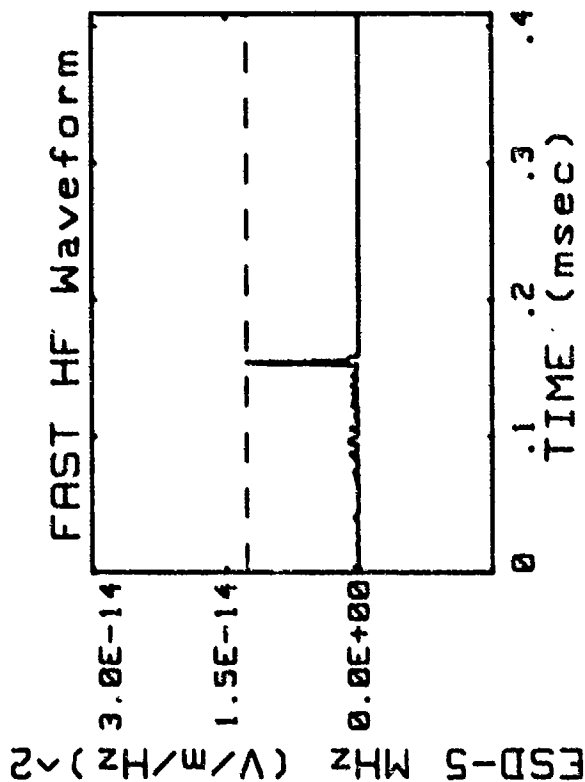
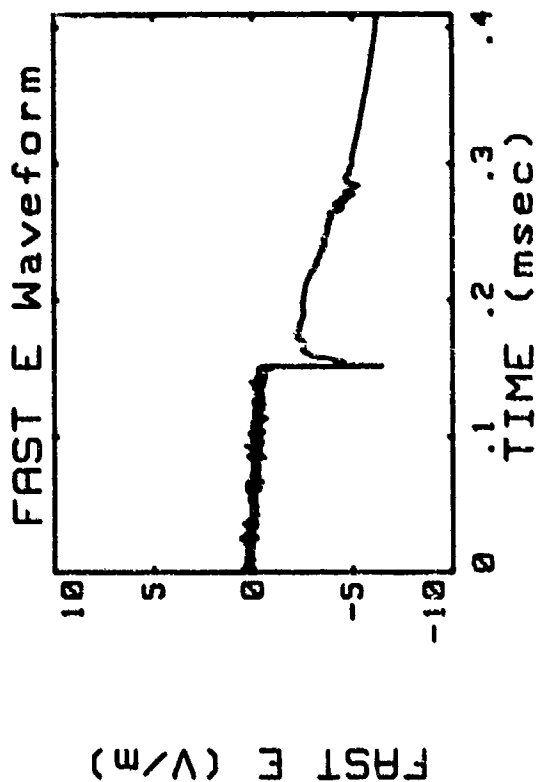
220193508.987 1985

1st RS (11.2 Km)



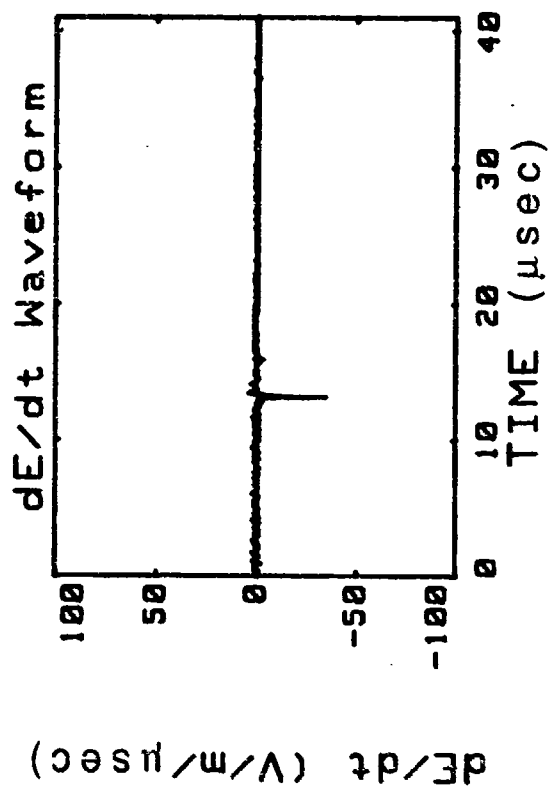
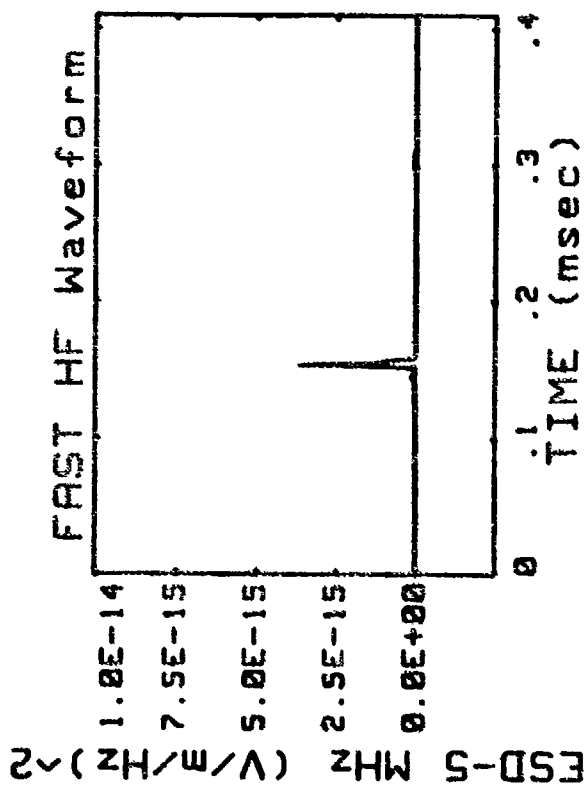
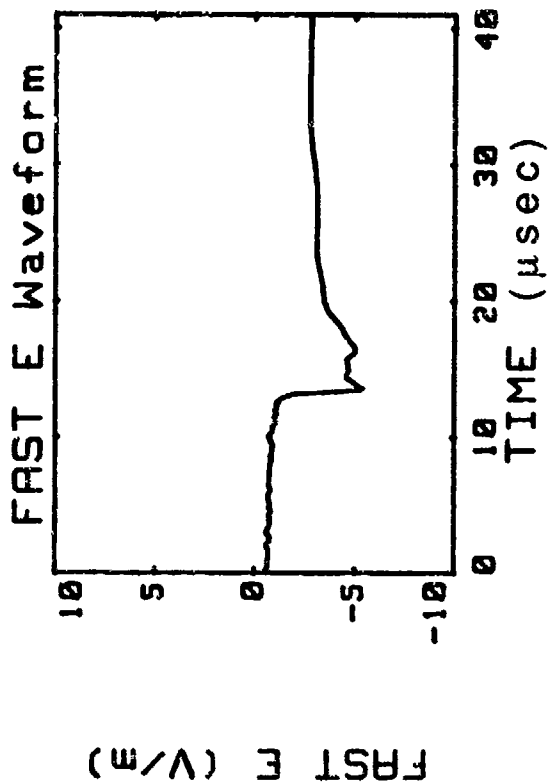
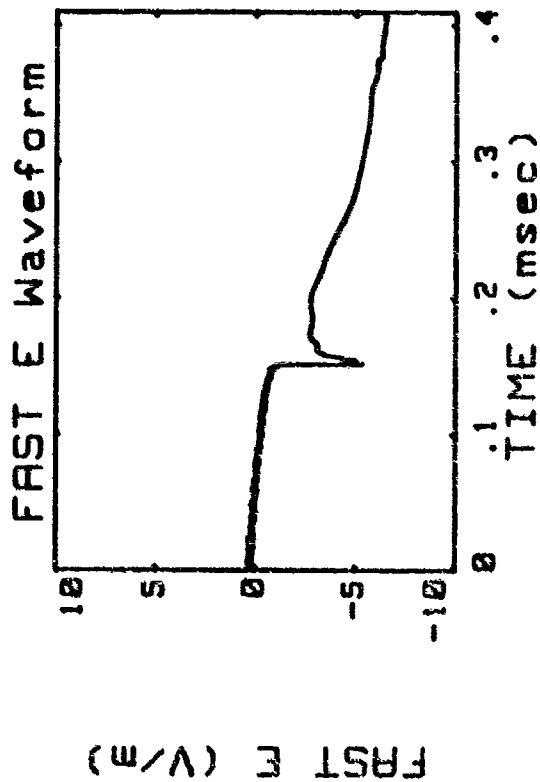
220193509.089 1985

Chaotic Subs RS (11.2 Km)

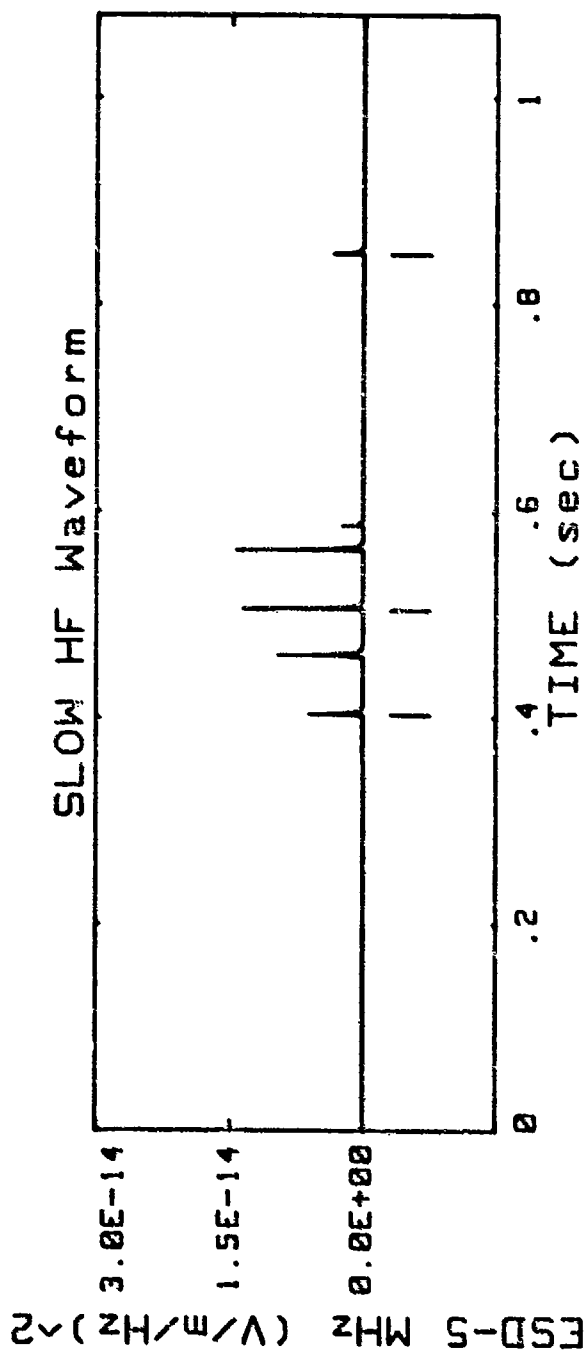
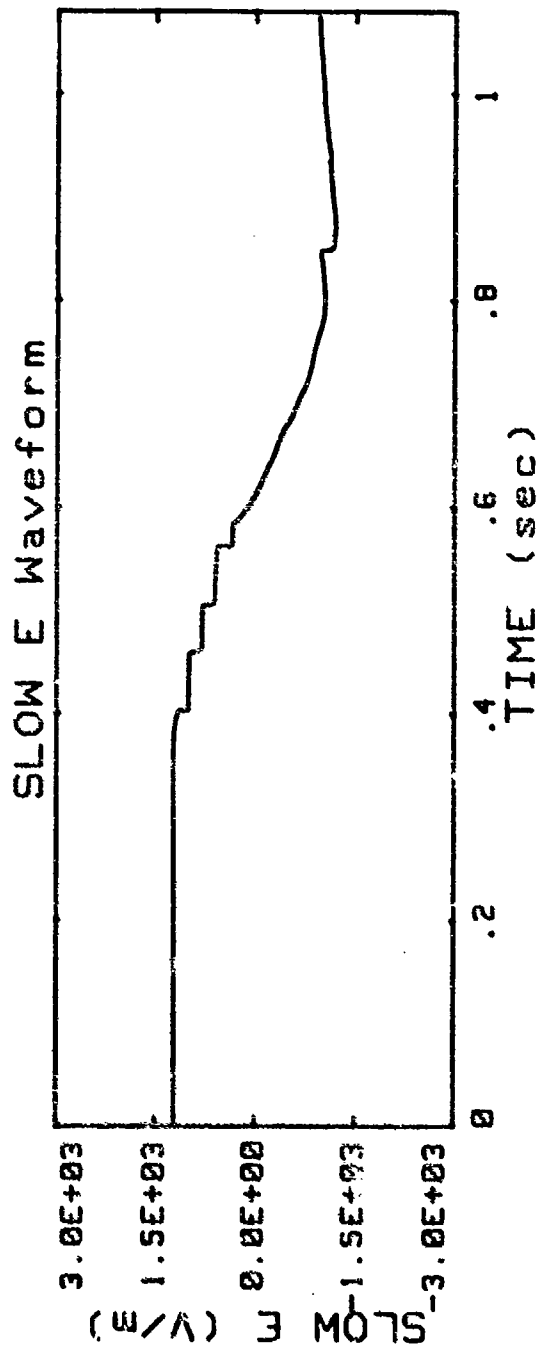


220193509.433 1985

Norm Subs RS (11.2 Km)

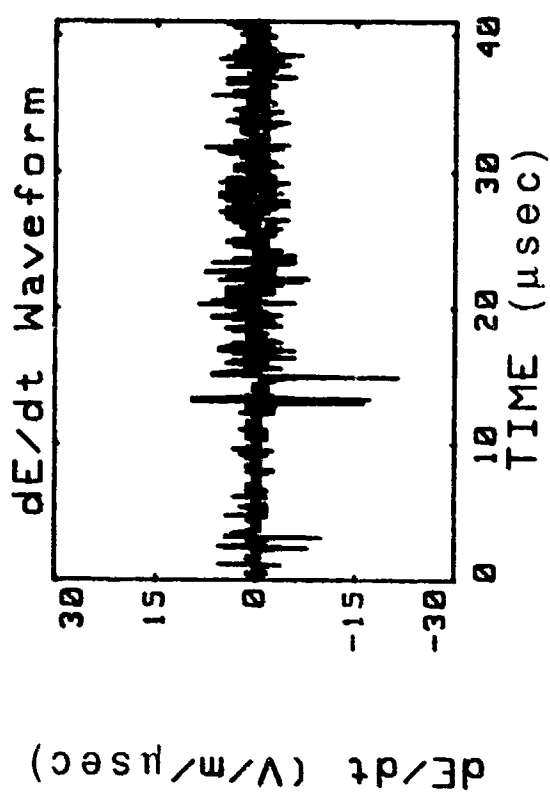
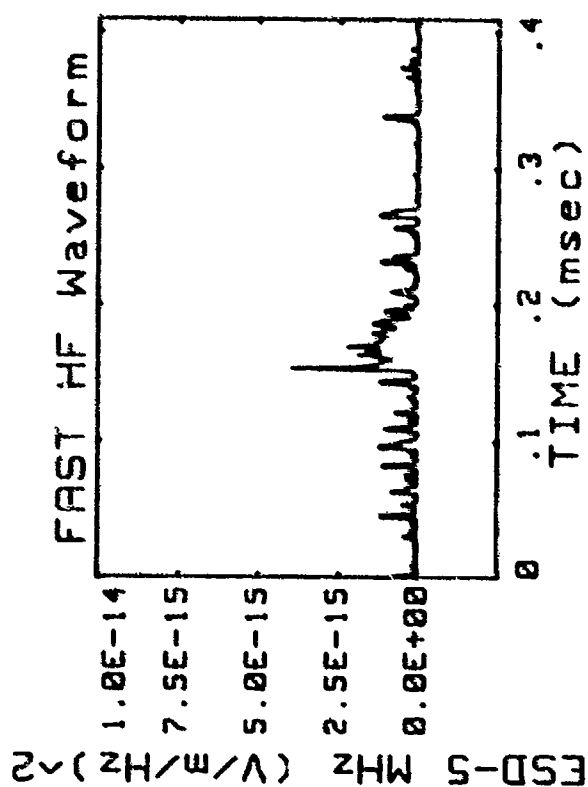
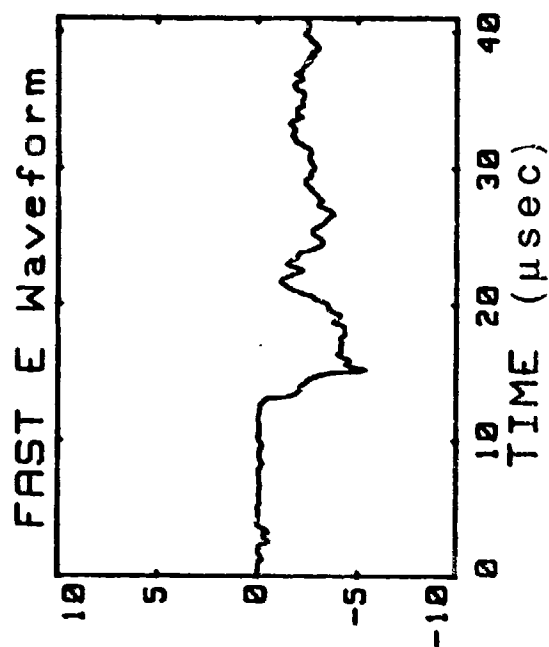
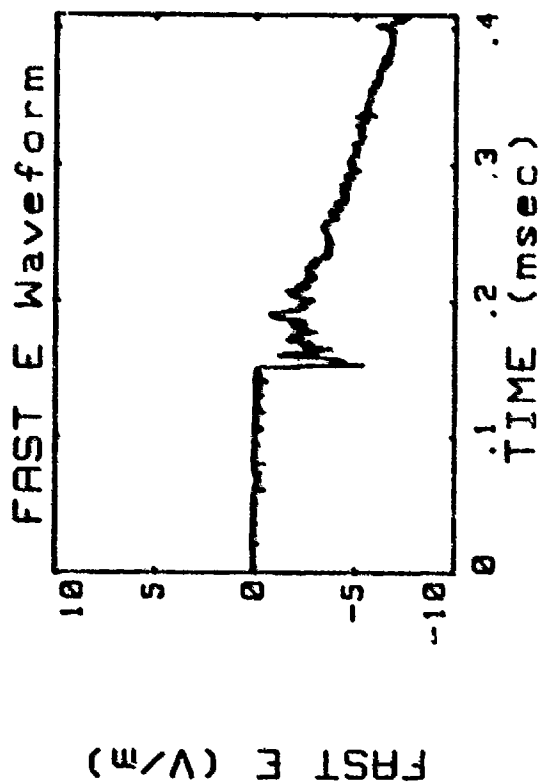


19:35:08.597 8 Aug 1985 (11.2 Km)

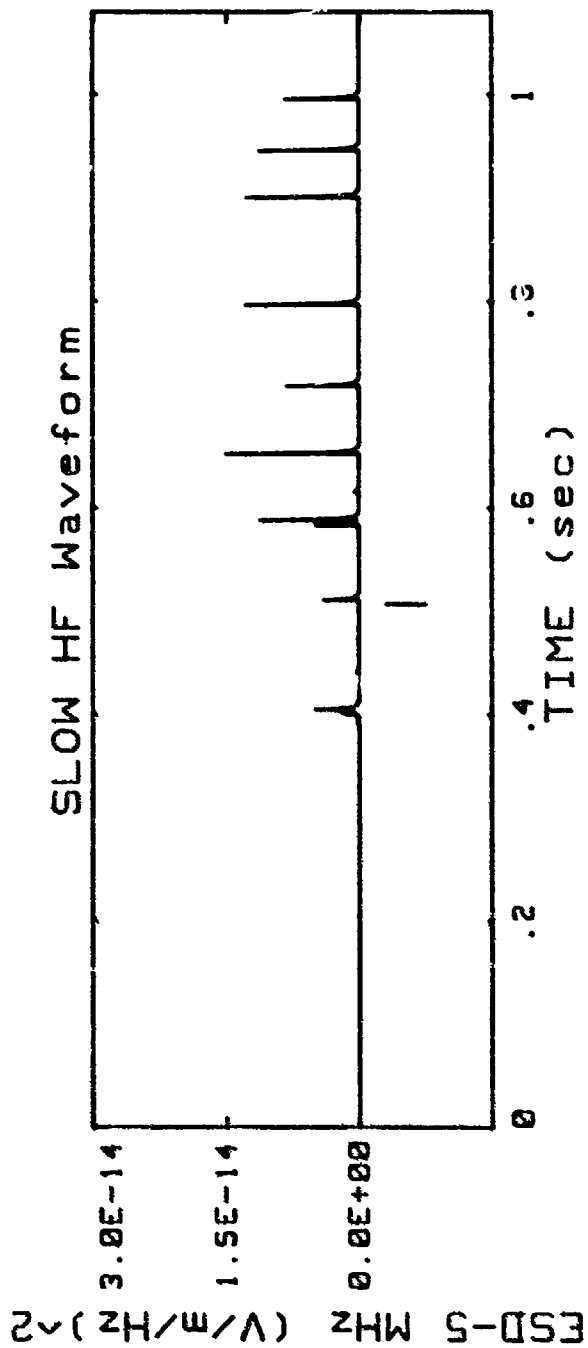
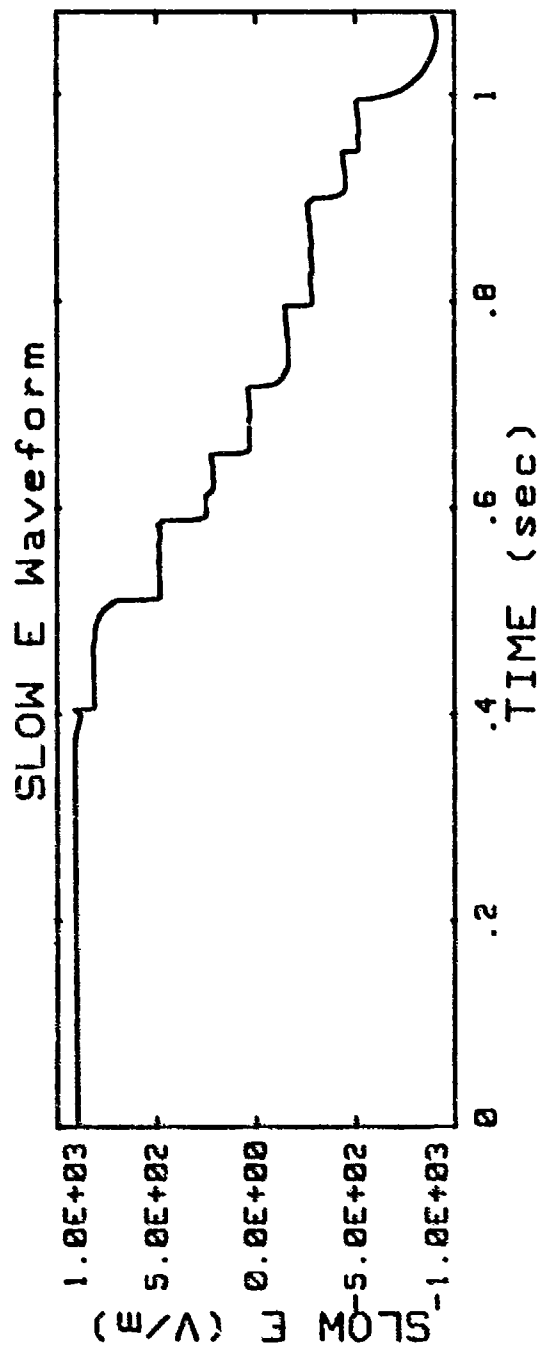


220193520.574 1985

1st RS (11.9 Km)

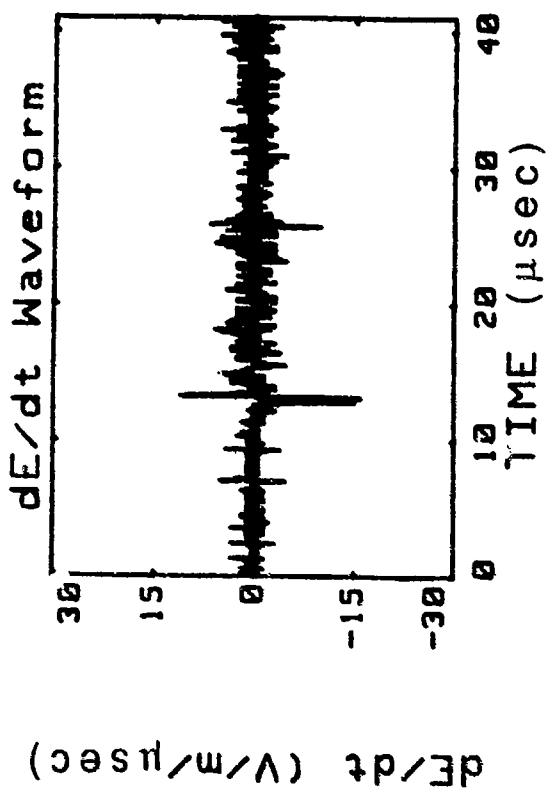
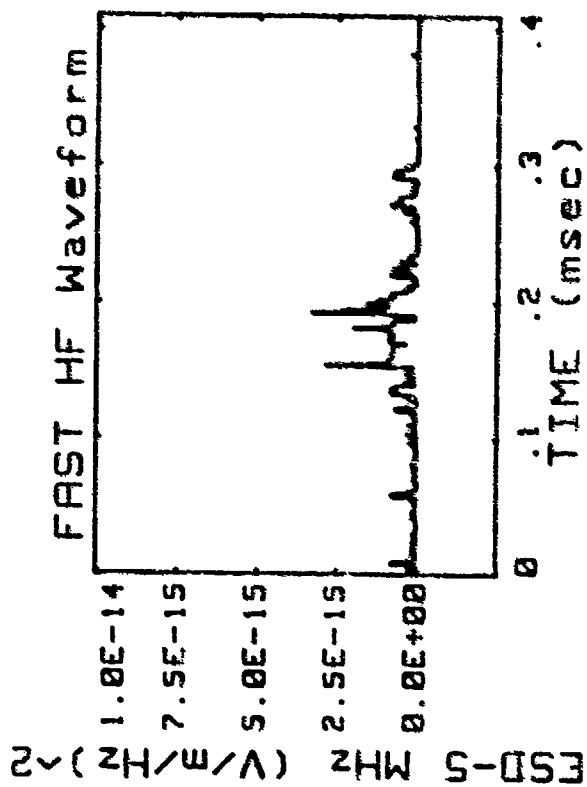
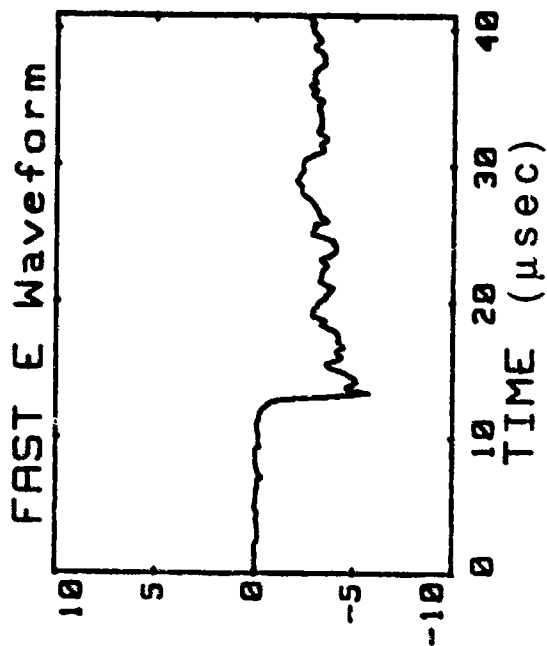
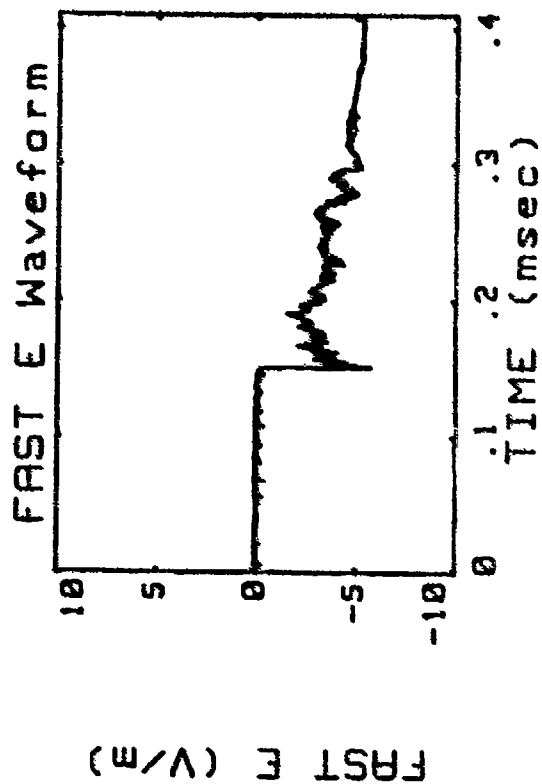


19:35:28.080 8 Aug 1985 (11.3 Km)

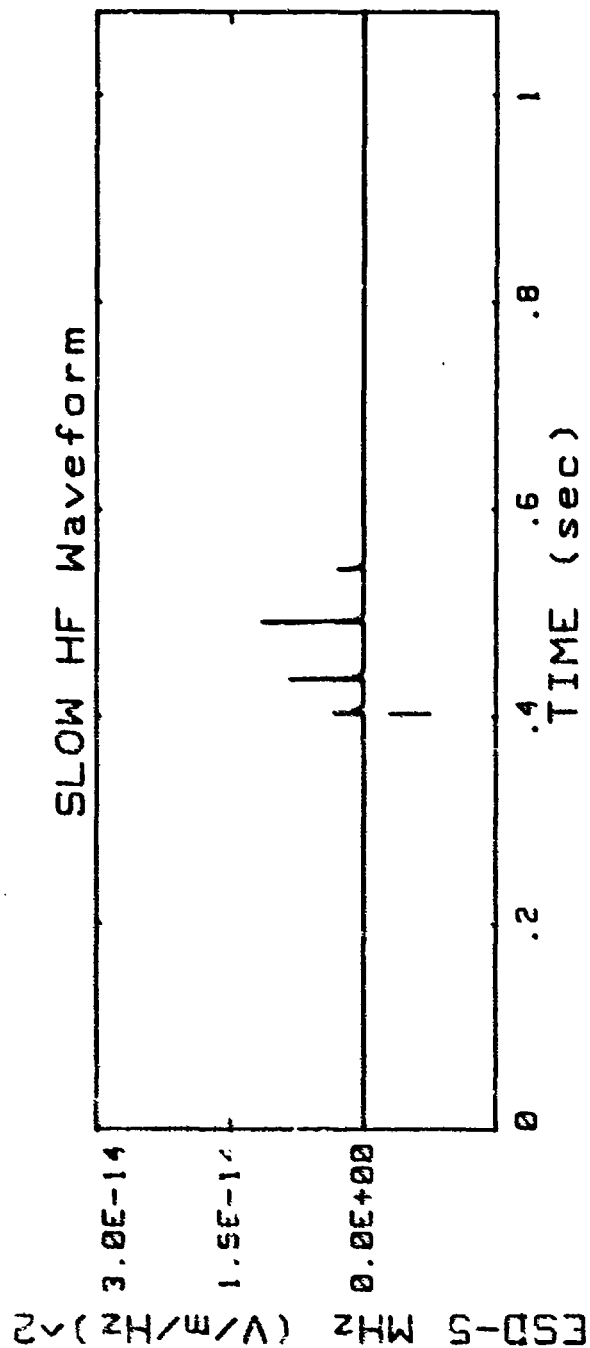
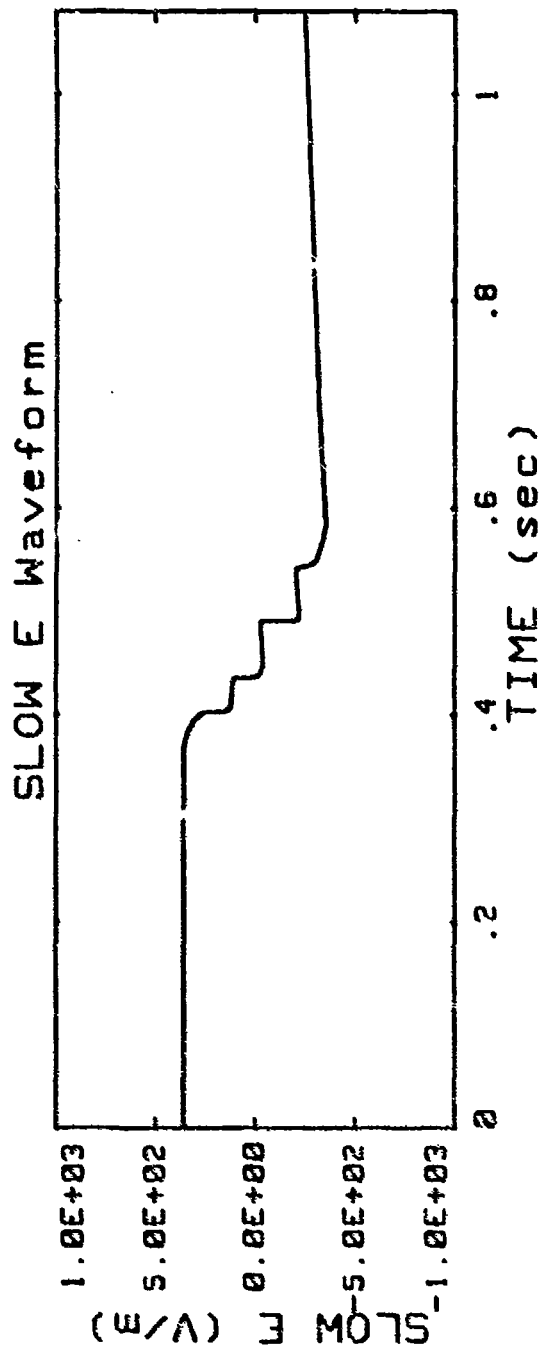


220193539.601 1985

1st RS (9.7 Km)

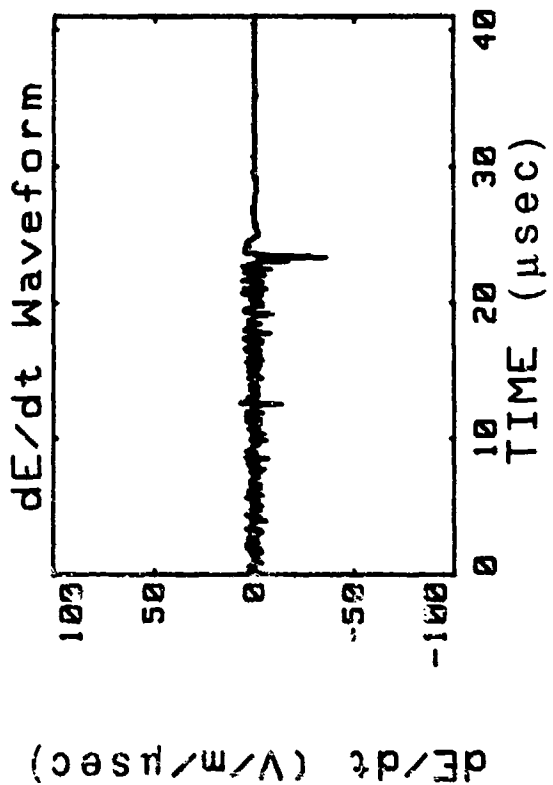
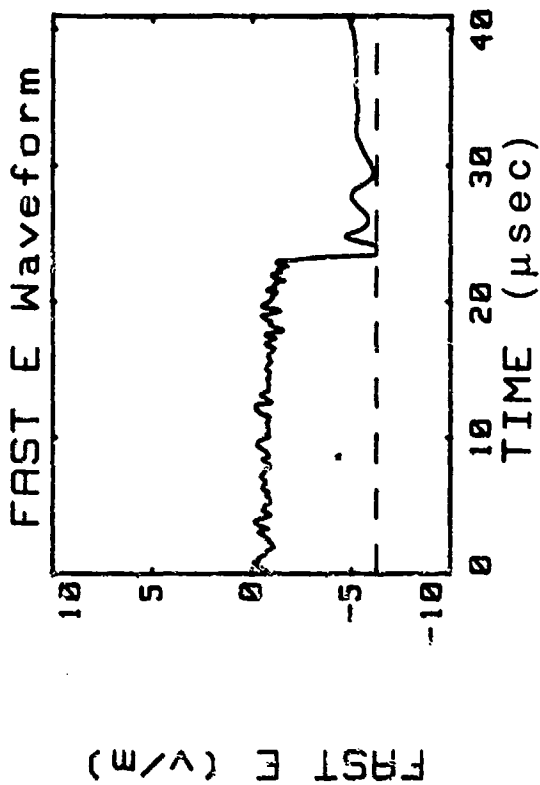
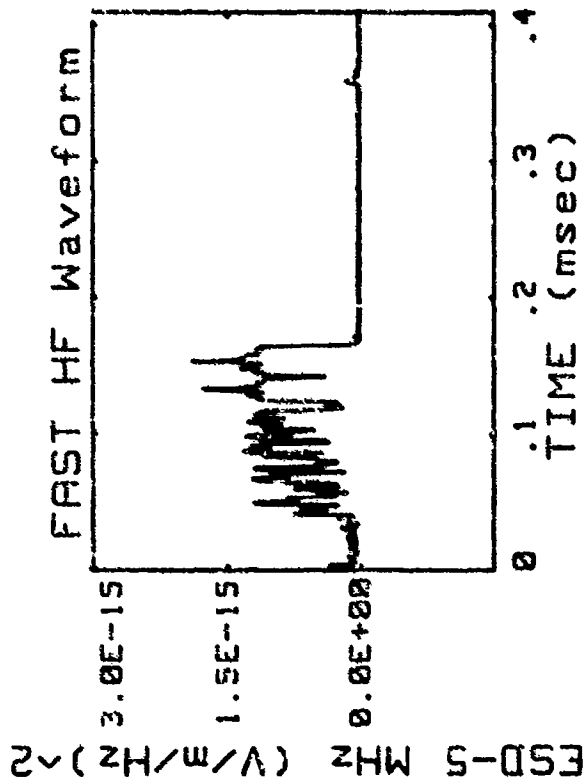
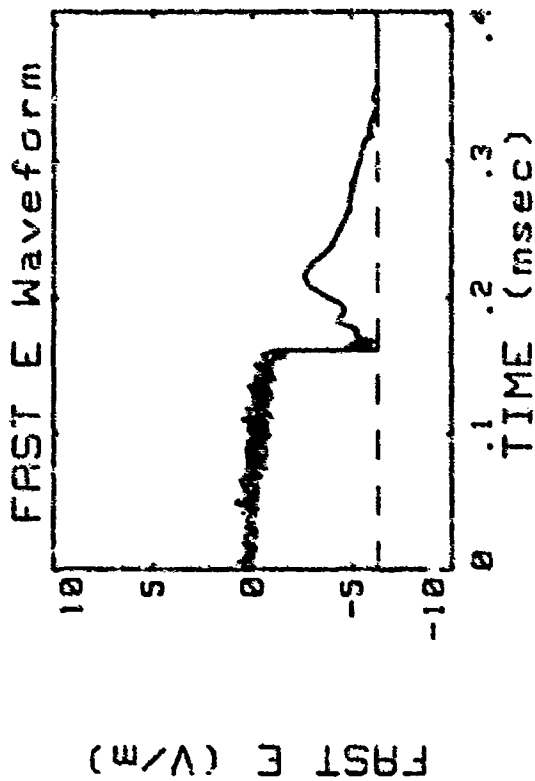


19:35:39.211 8 Aug 1985 (9.7 Km)

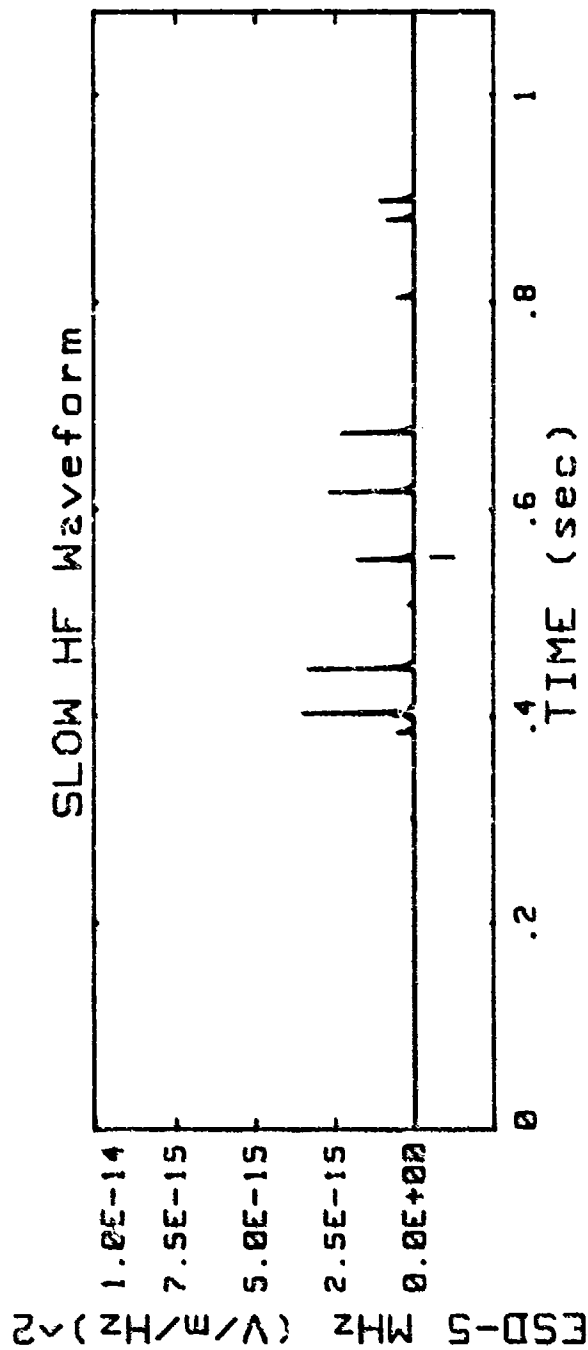
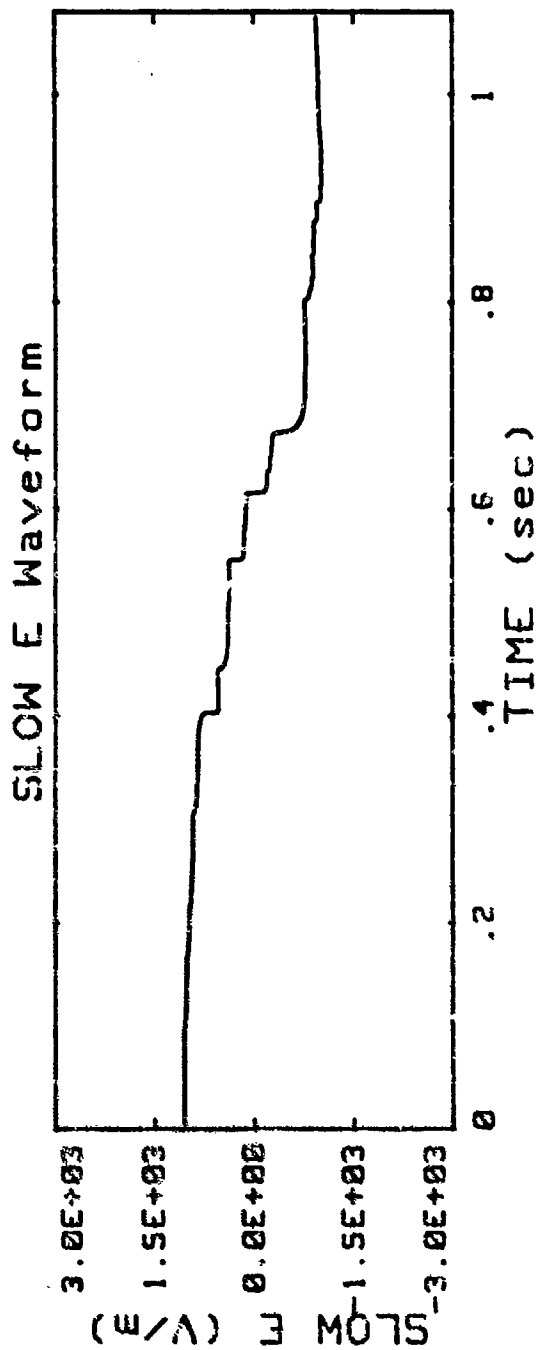


220193623.877 1985

Chaotic Subs RS (11.8 Km)

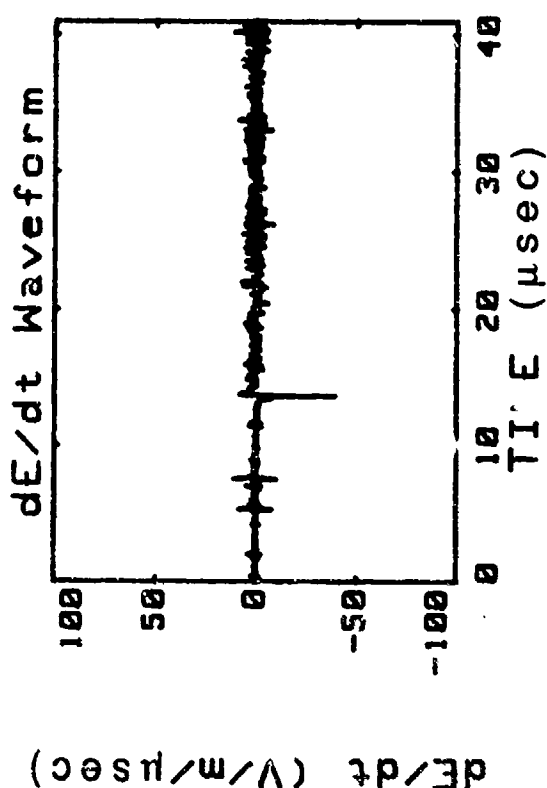
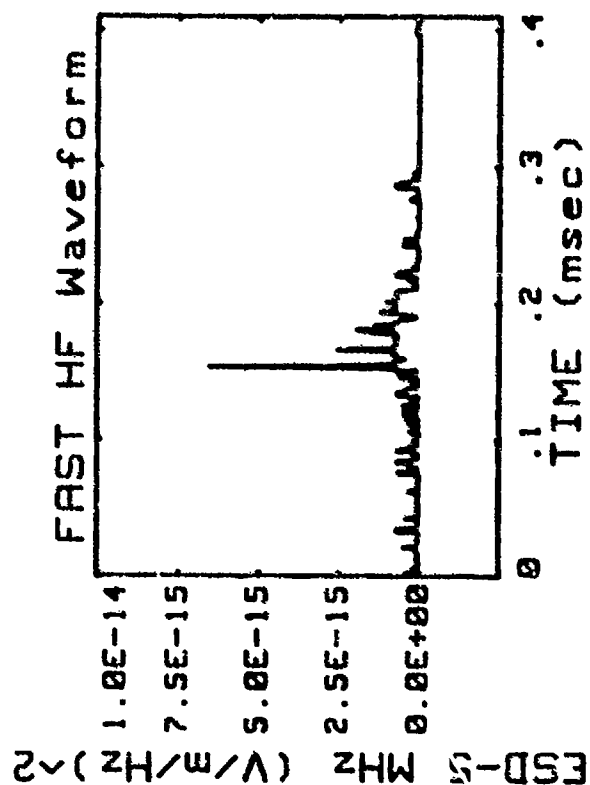
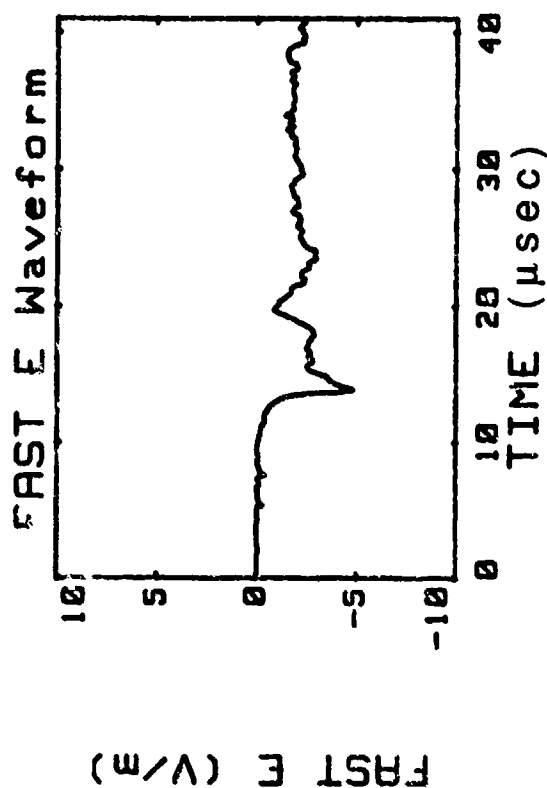
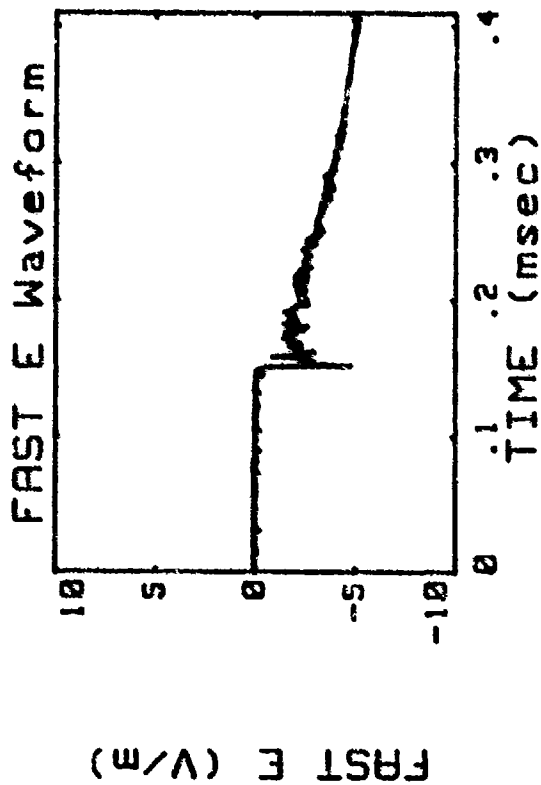


19:36:23.336 8 Aug 1985 (11.8 Km)



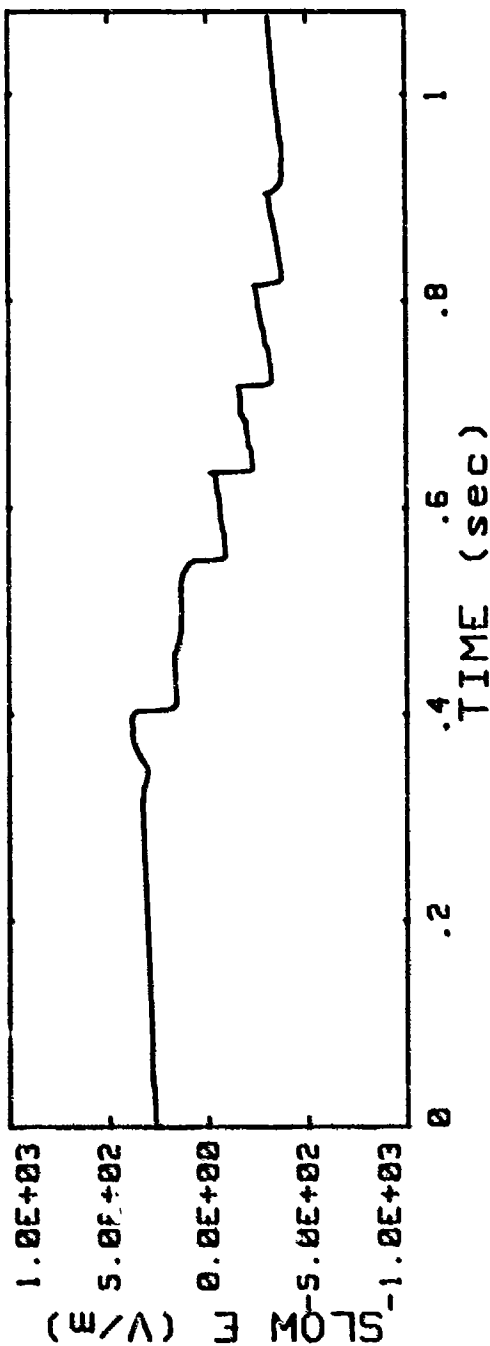
220193629.819 1985

1st RS (0.9 Km)

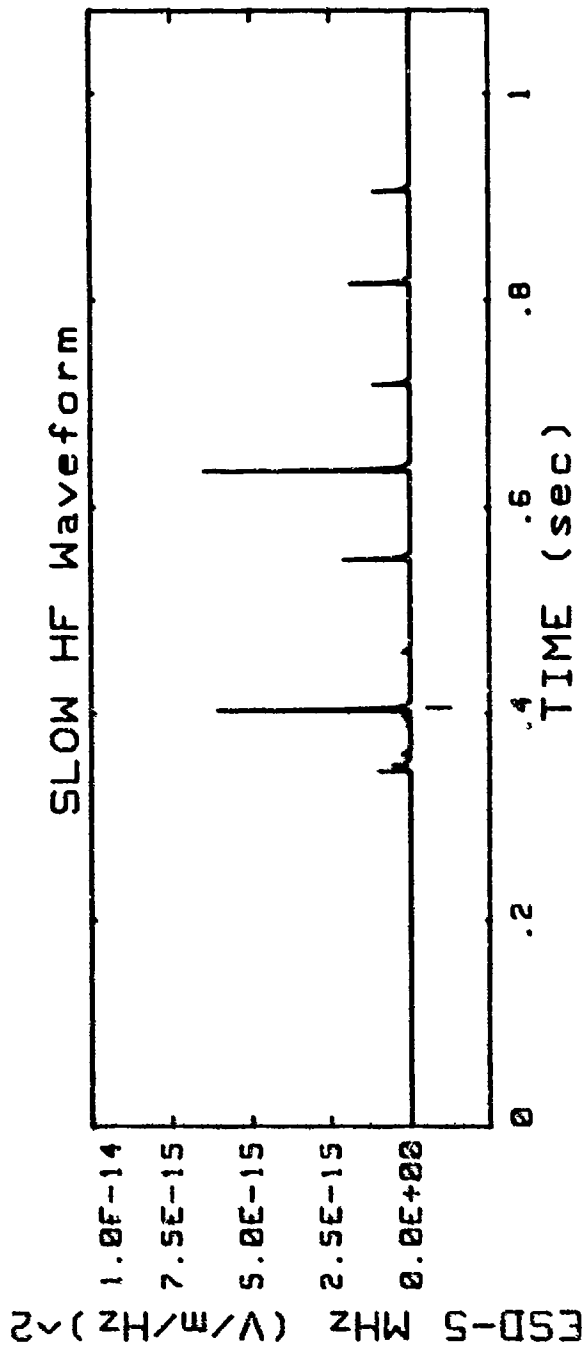


19:36:29.426 8 Aug 1985 (8.9 Km)

SLOW E Waveform

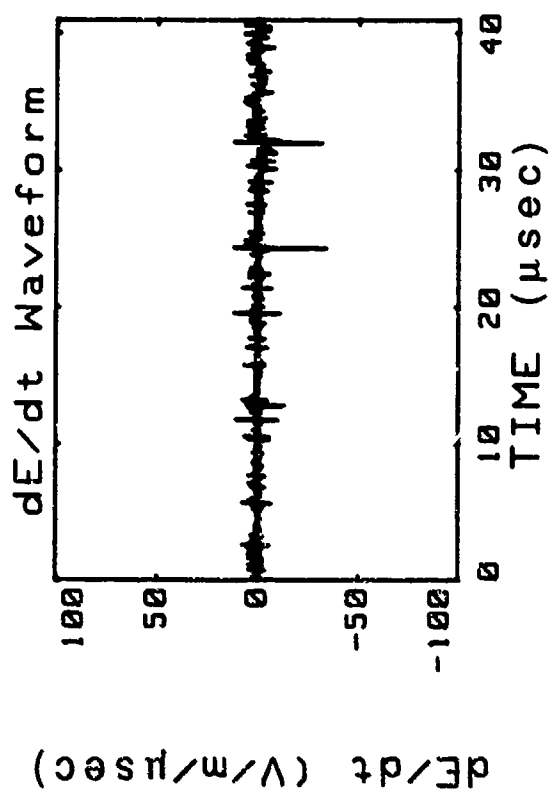
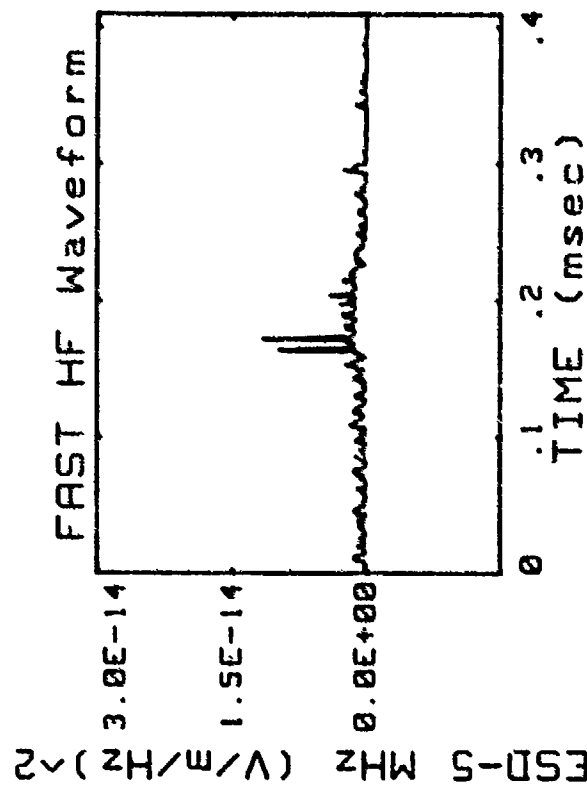
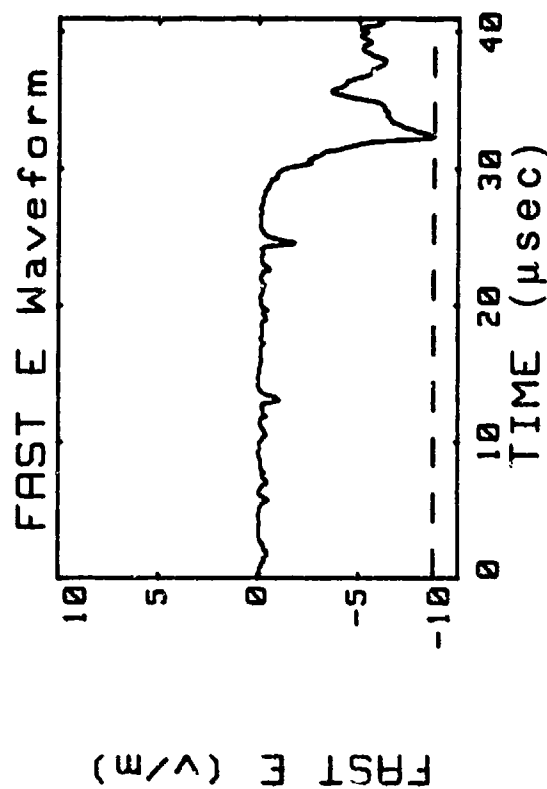
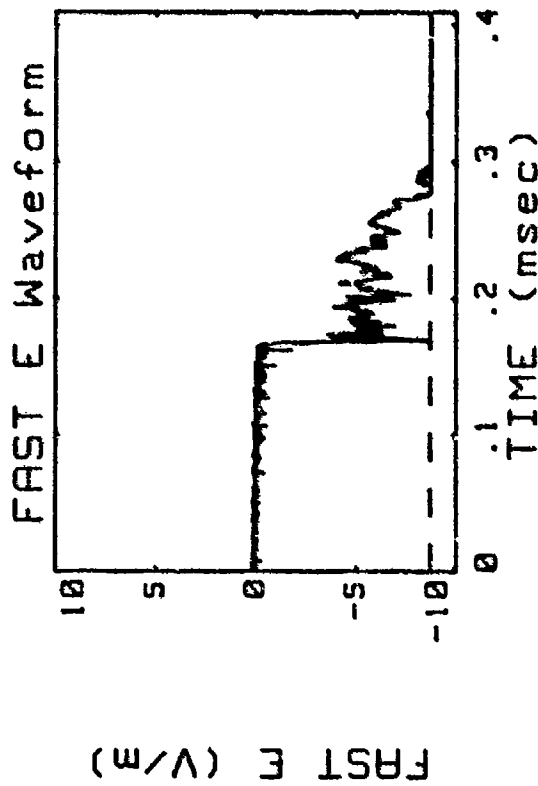


SLOW HF Waveform

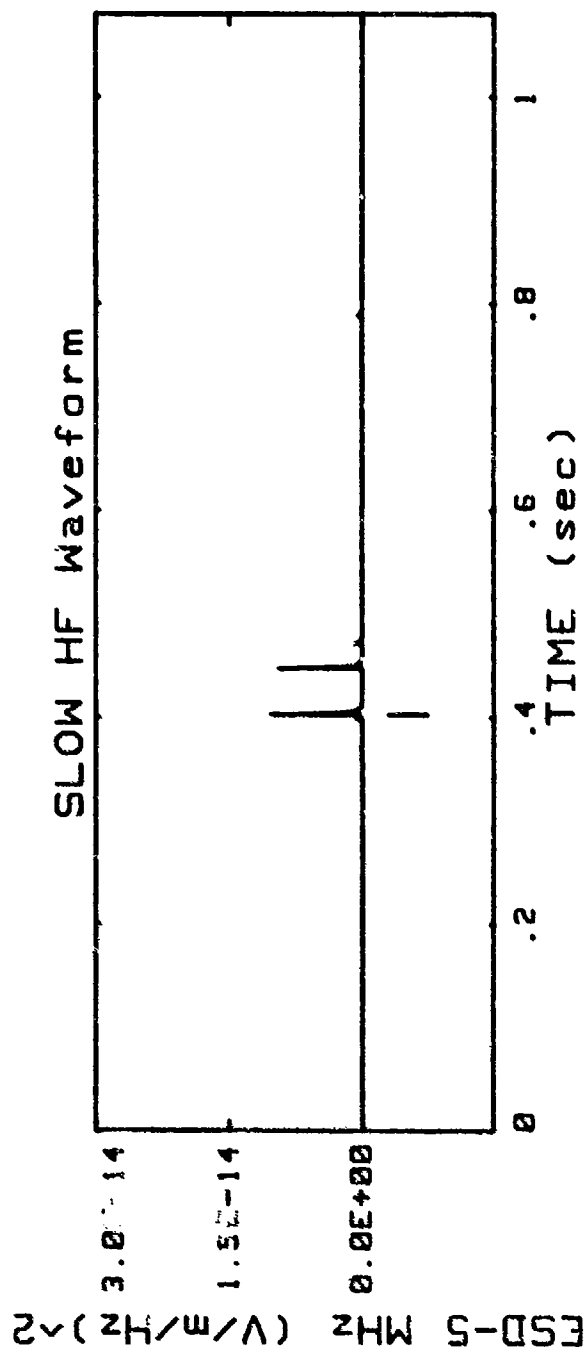
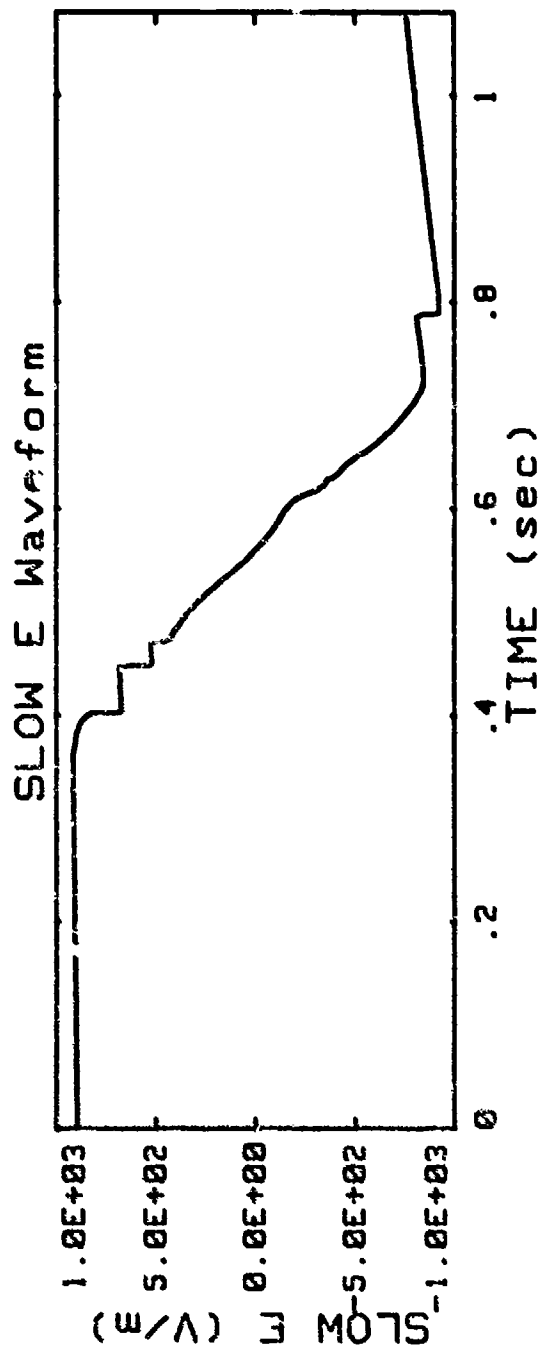


220193643.599 1985

1st RS (12.4 Km)

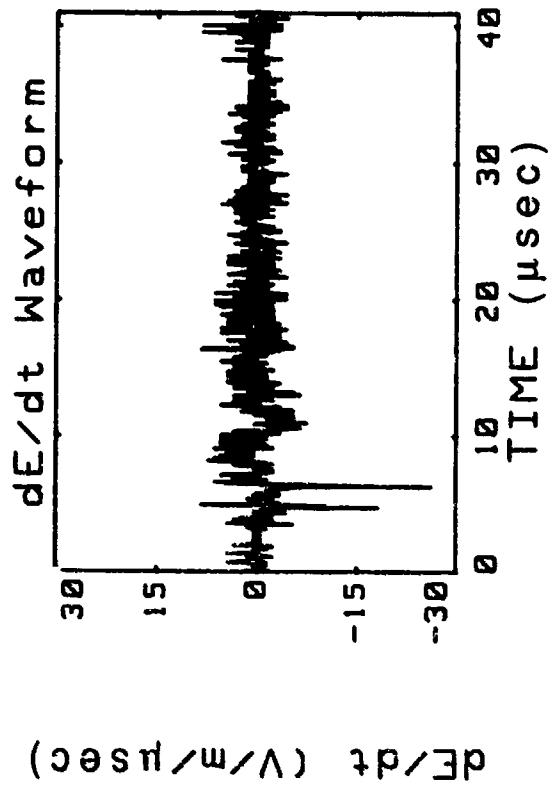
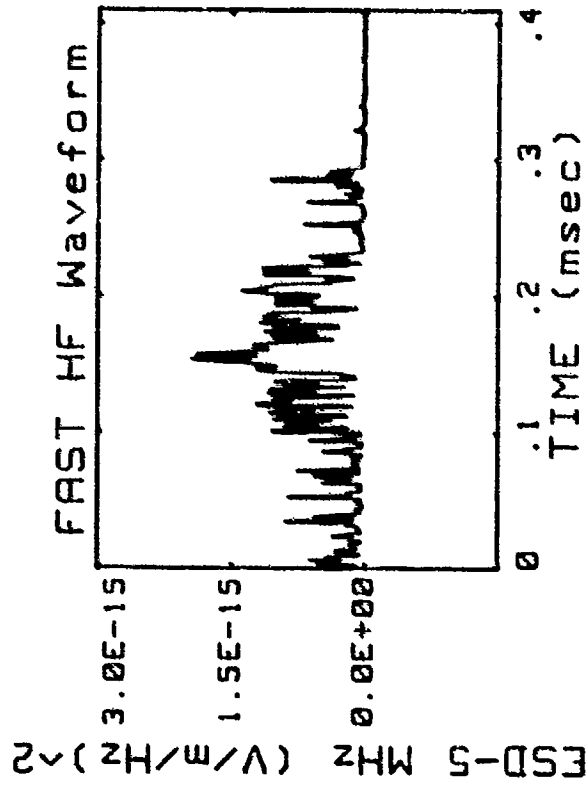
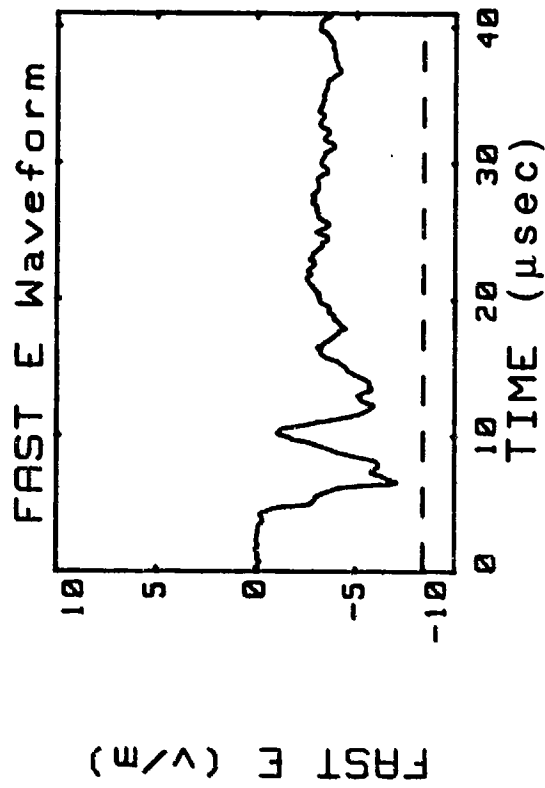
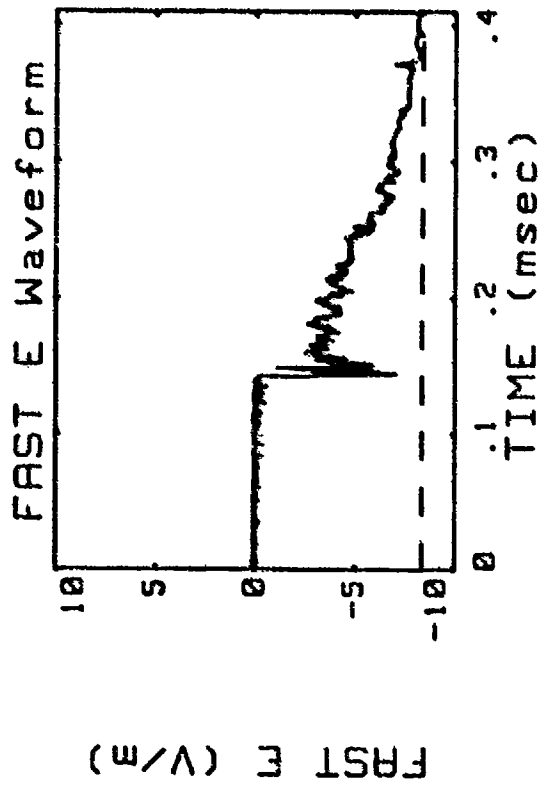


19:36:43.209 8 Aug 1985 (12.4 Km)



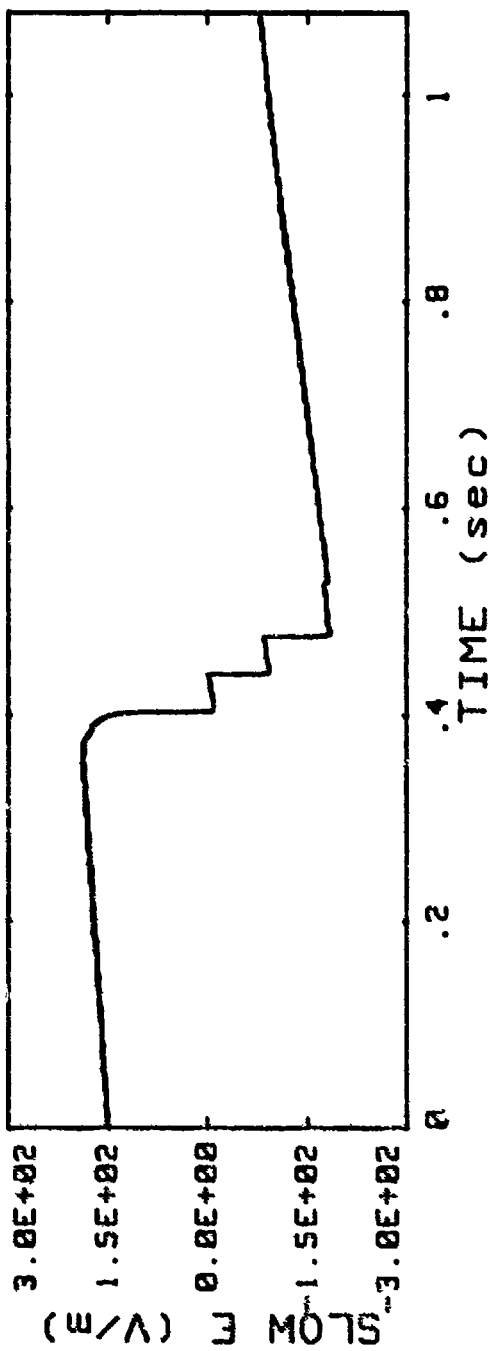
220193650.856 1985

1st RS (11.4 Km)

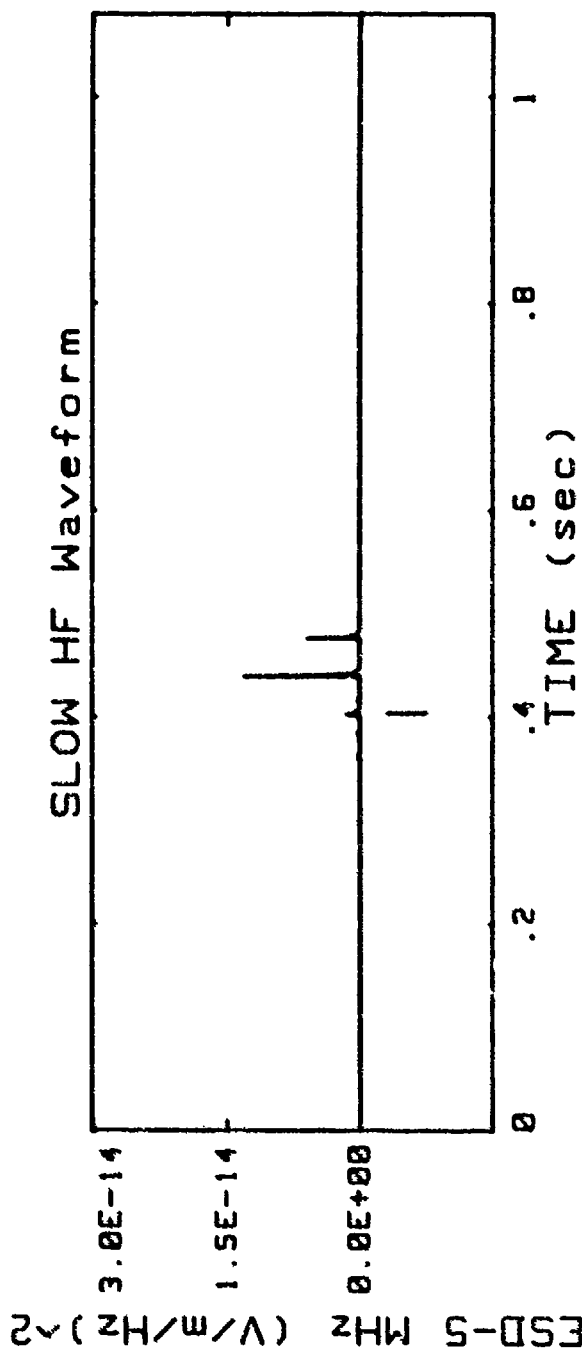


19:35:50.465 8 Aug 1985 (11.4 Km)

SLOW E Waveform

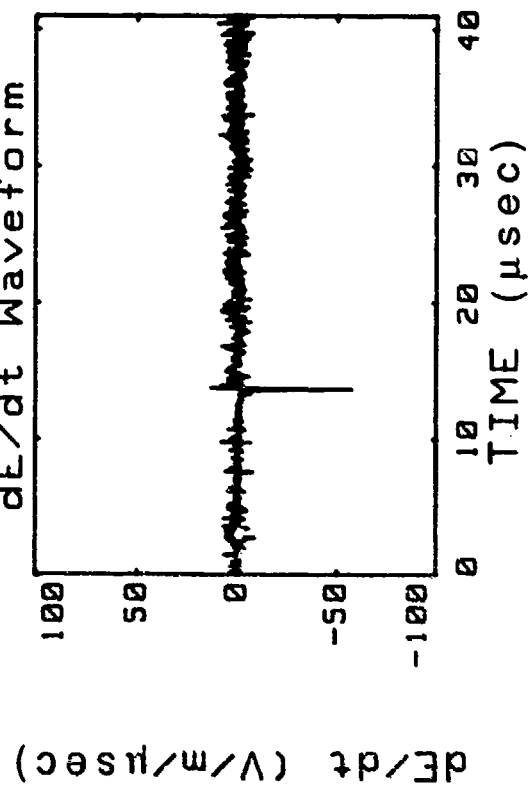
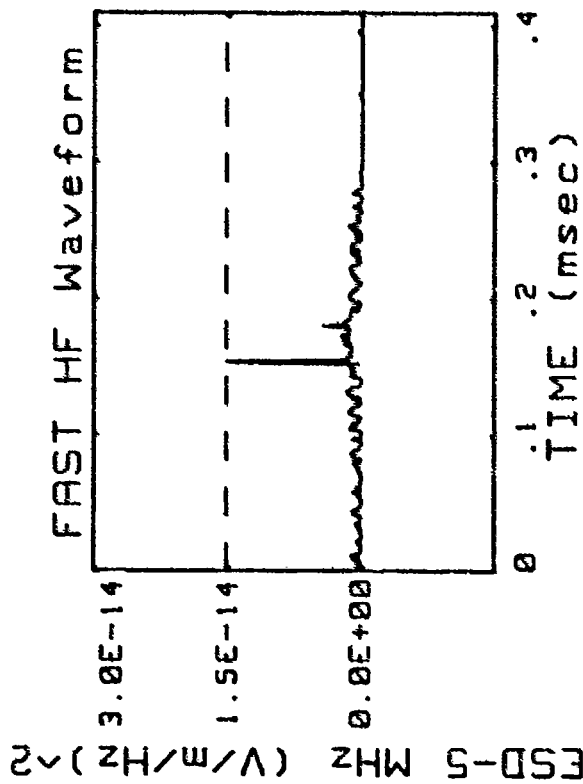
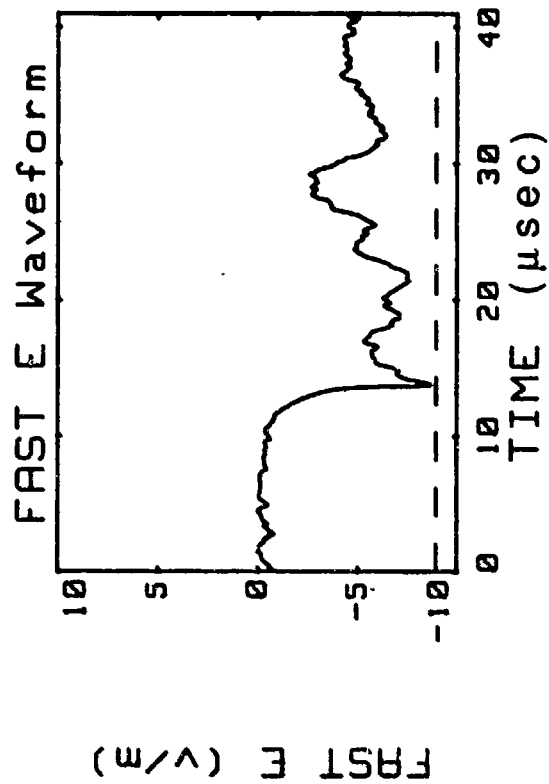
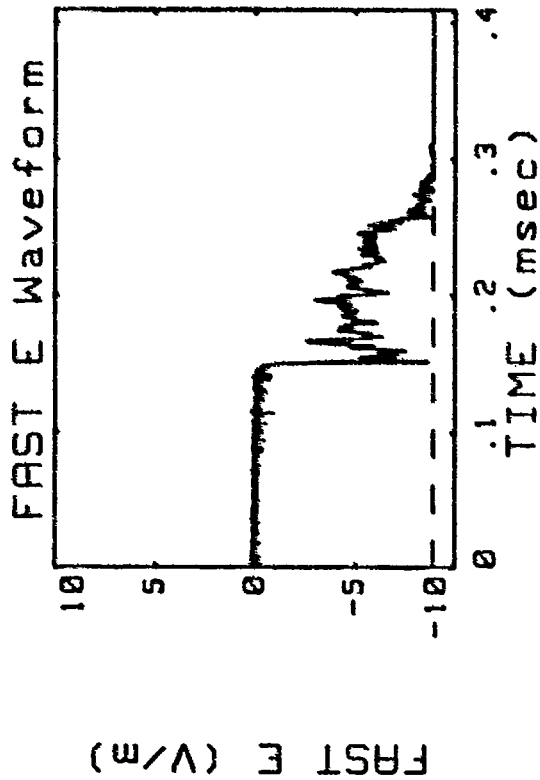


SLOW HF Waveform



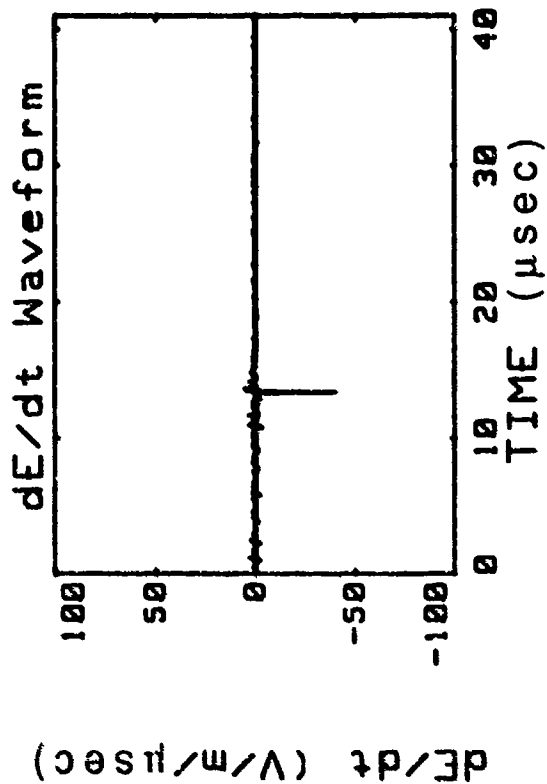
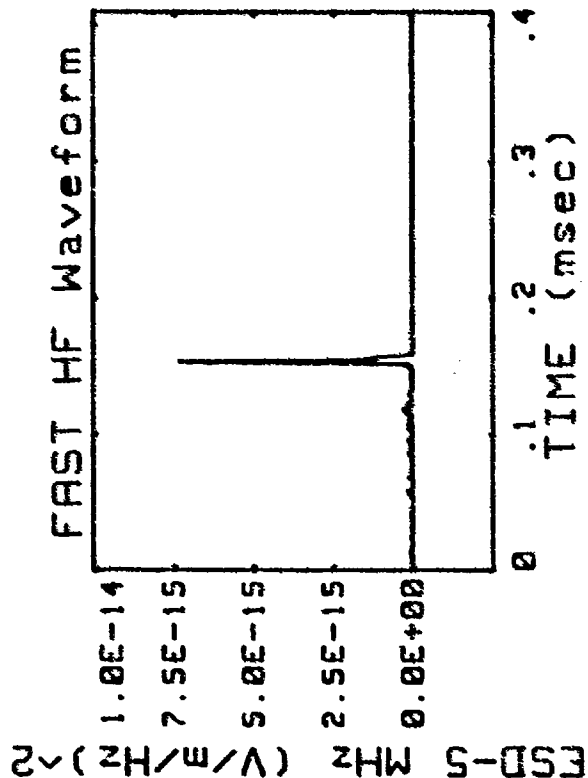
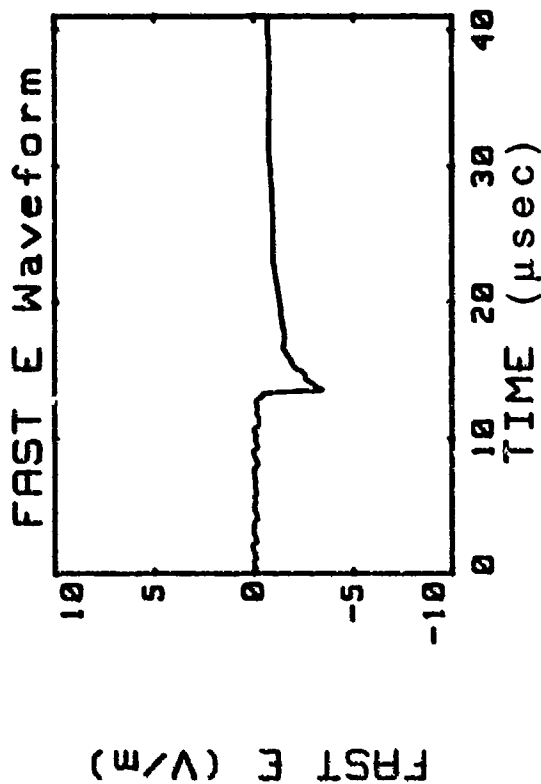
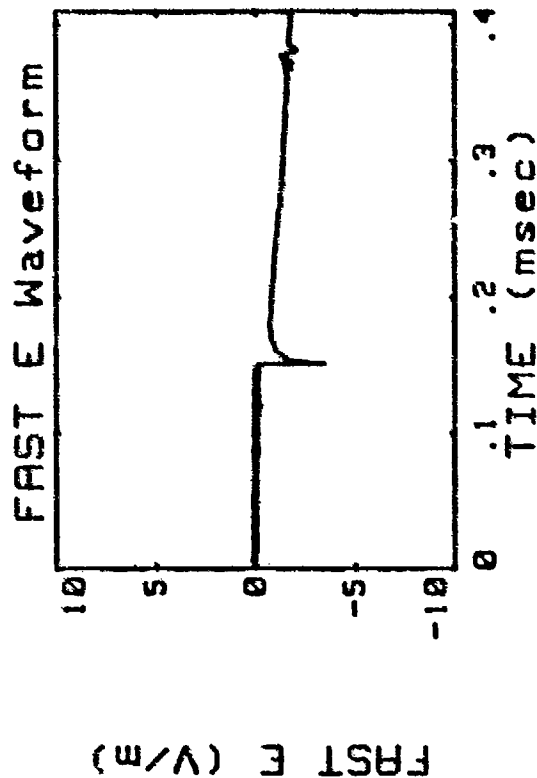
220193659.369 1985

1st RS (12.3 Km)

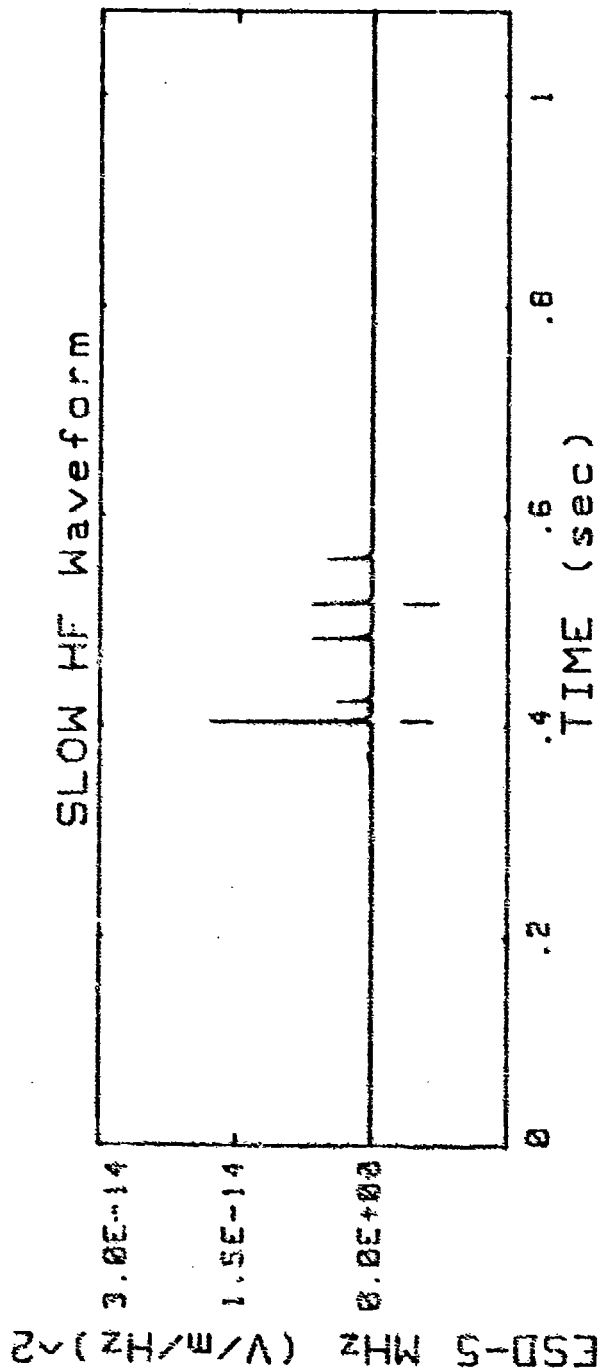
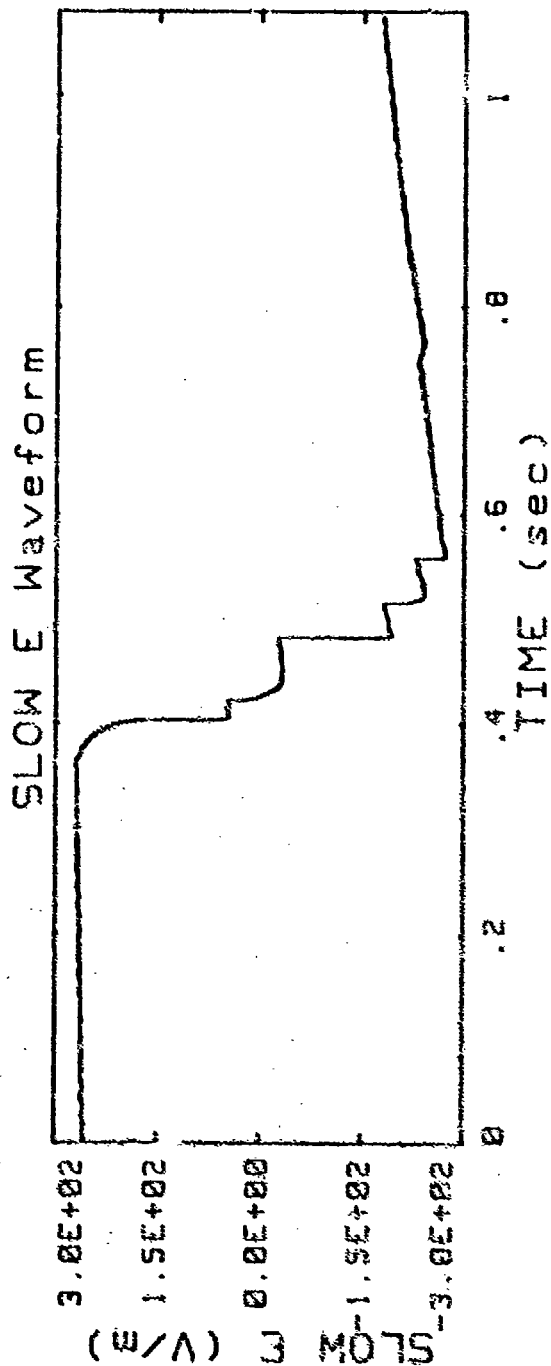


220193659.482 1985

Norm Subs RS (12.3 Km)

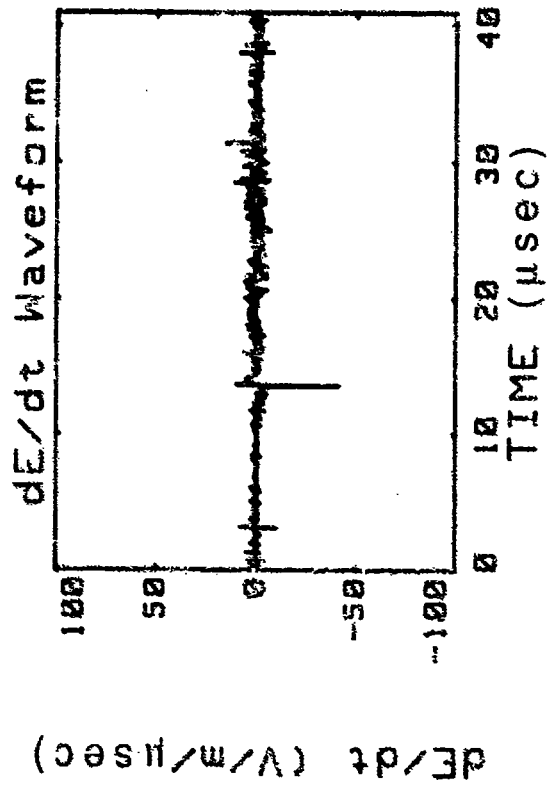
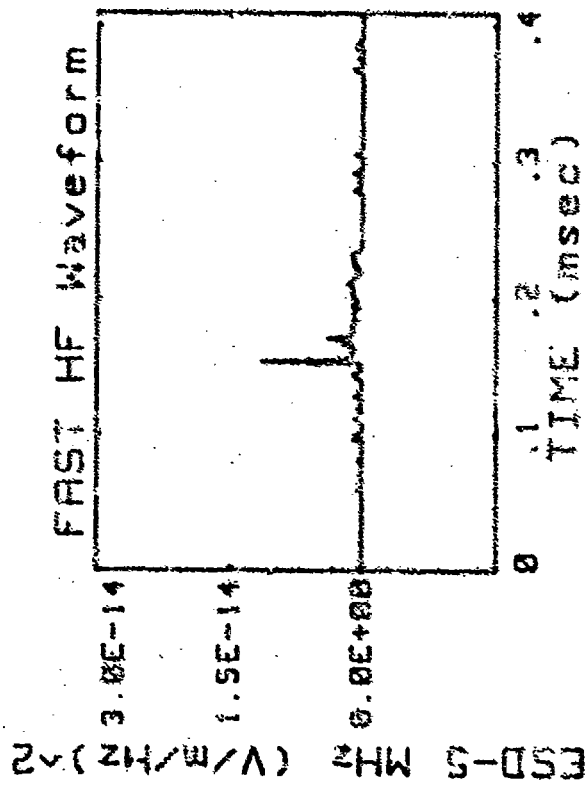
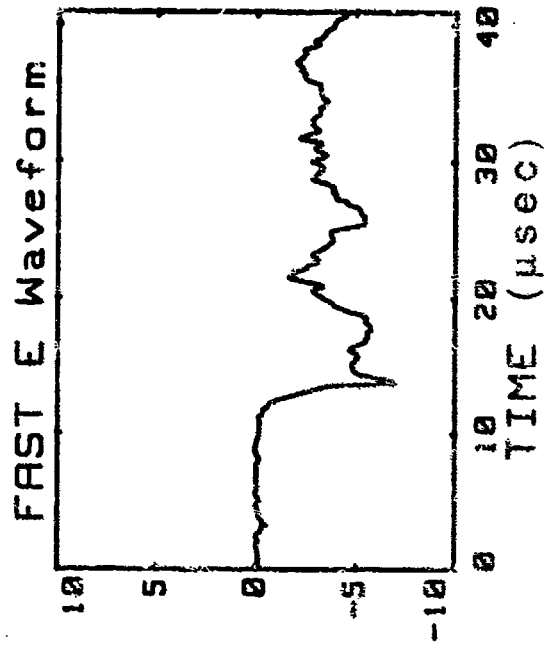
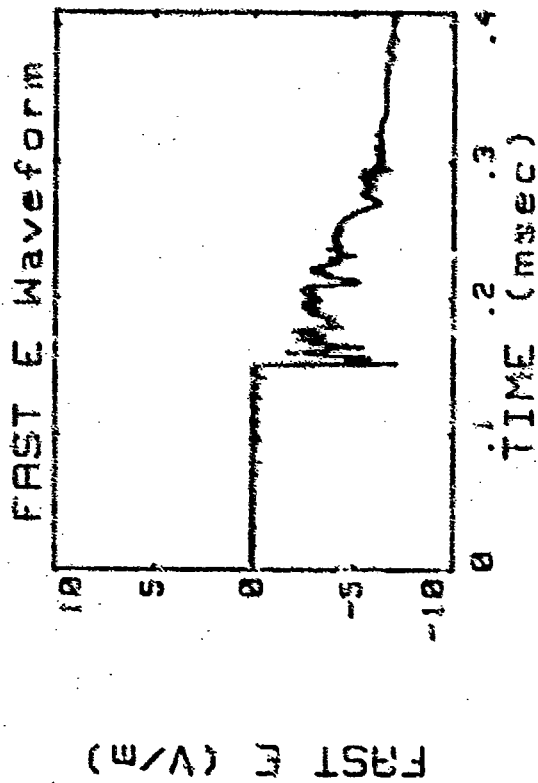


19:36:58.974 8 Aug 1985 (12.3 Km)

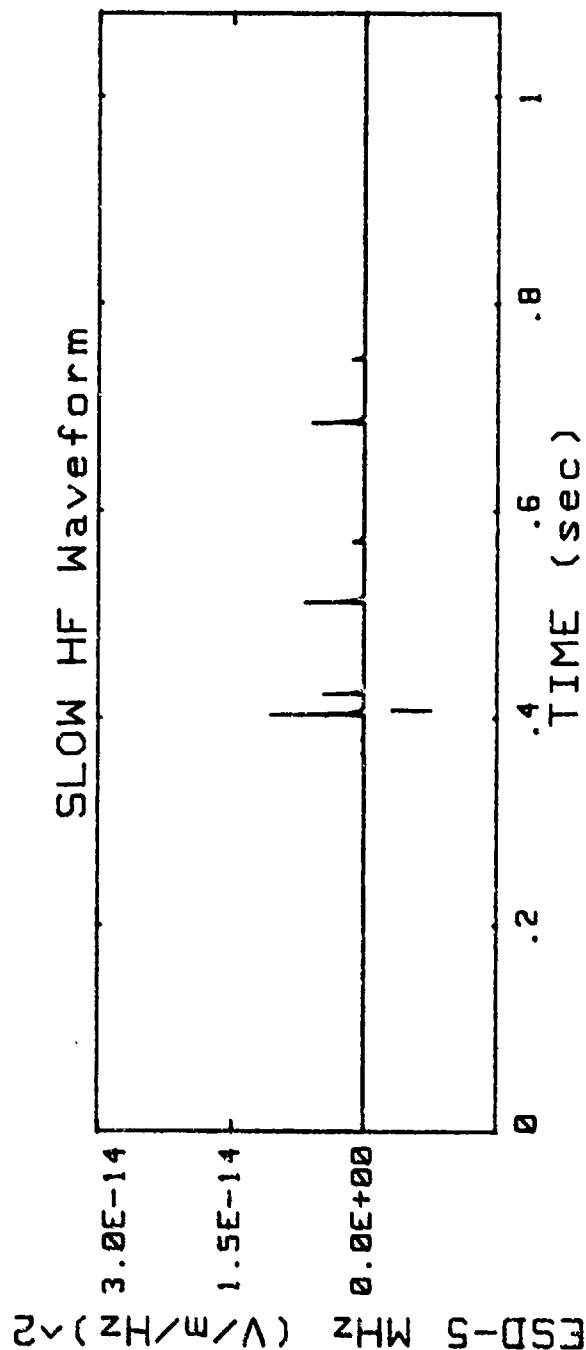
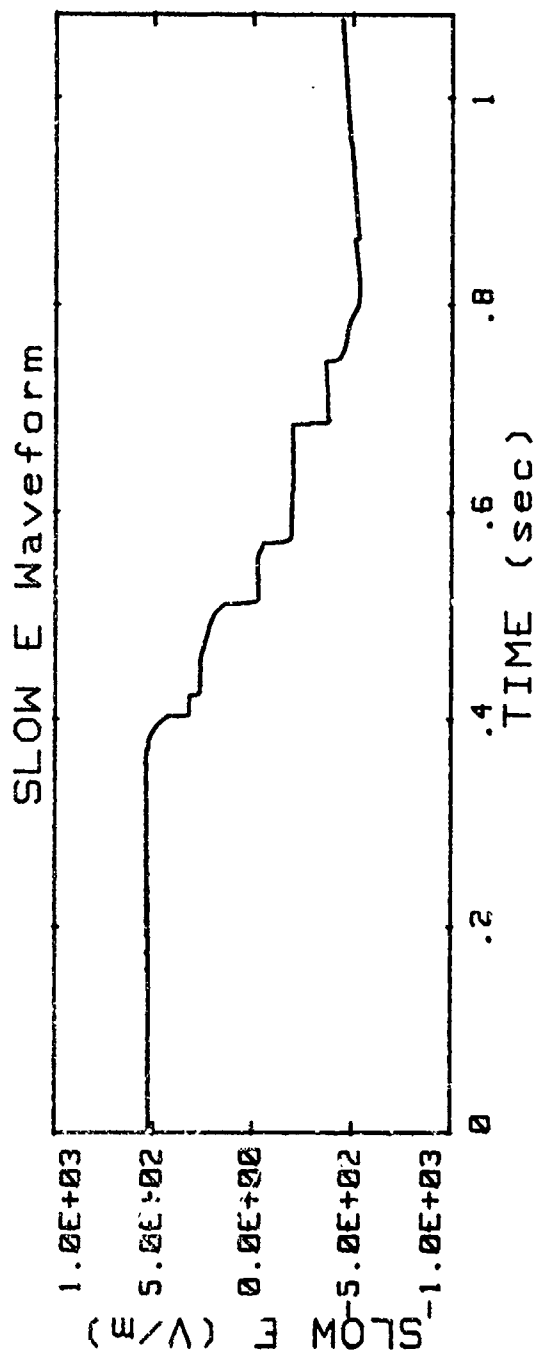


220193706.087 1985

1st RS (11.7 Km)

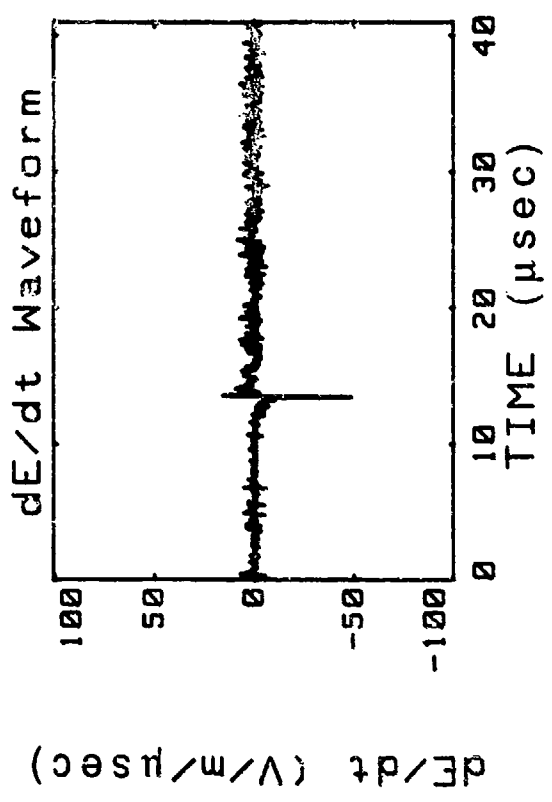
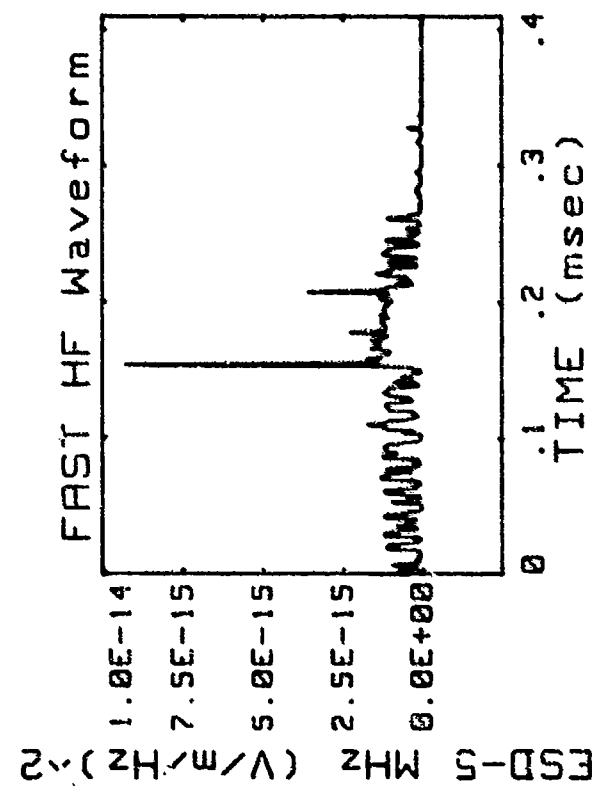
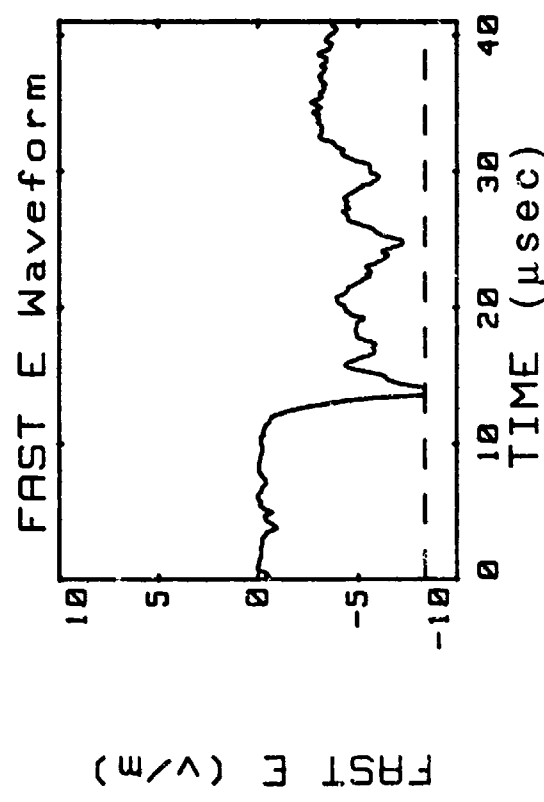
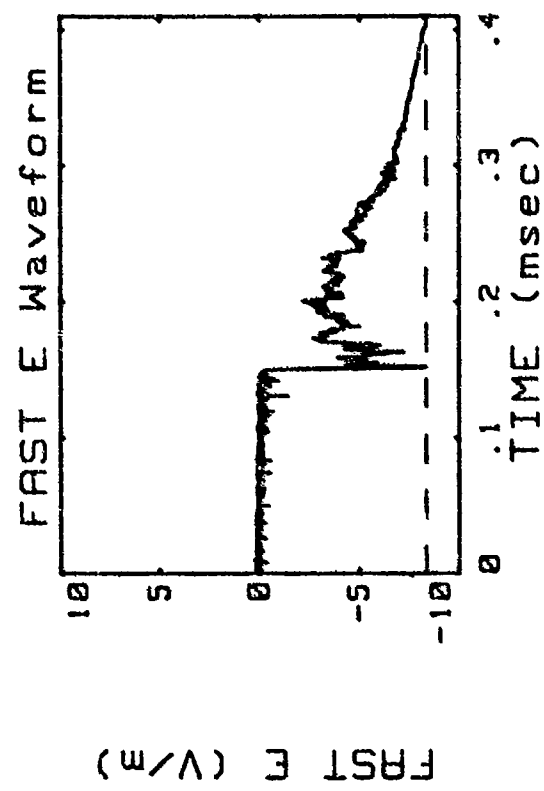


19:37:05.692 8 Aug 1985 (11.7 Km)

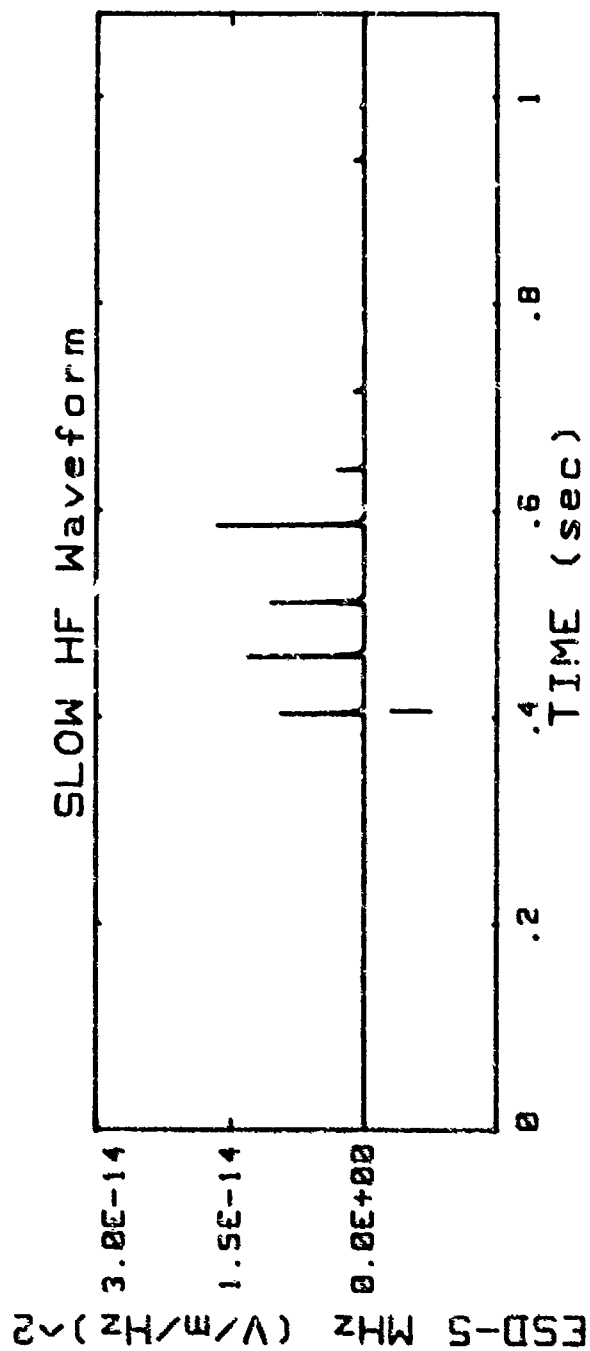
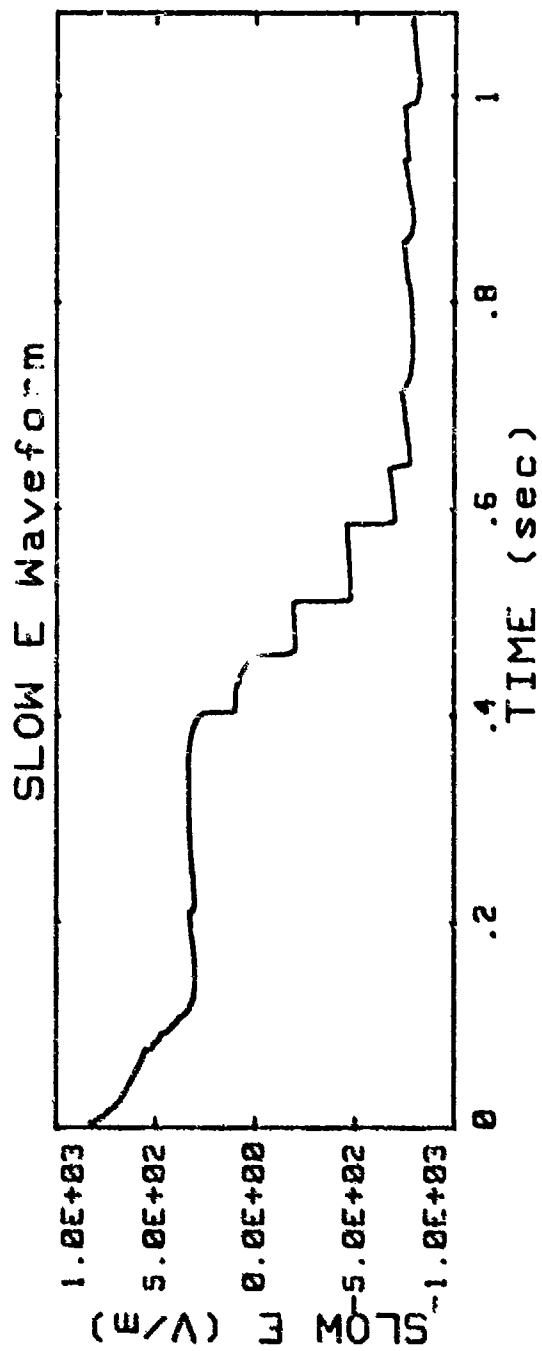


220193725.108 1985

1st RS (11.6 Km)

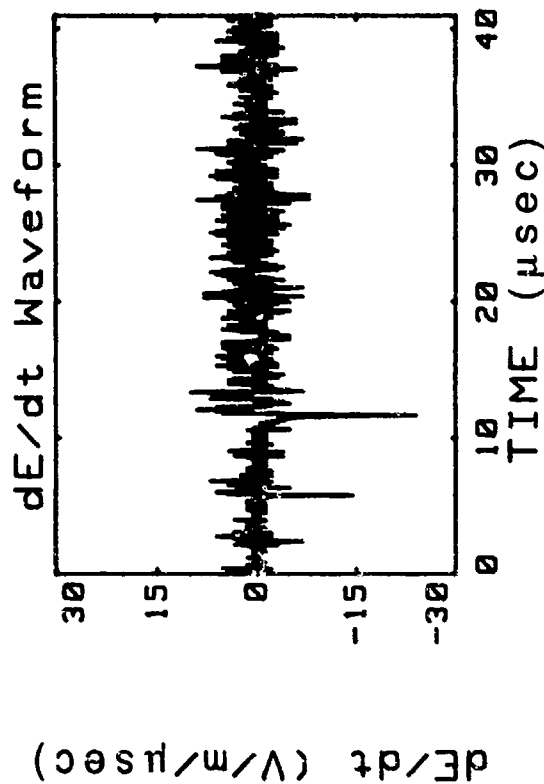
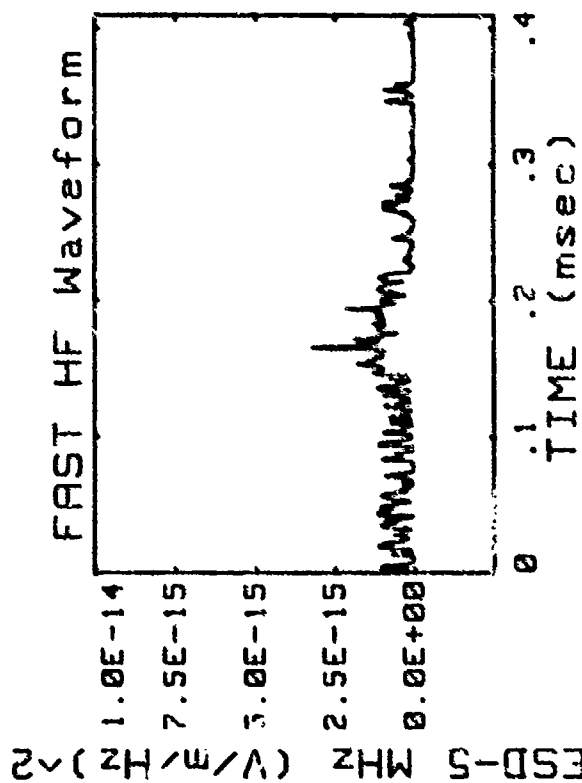
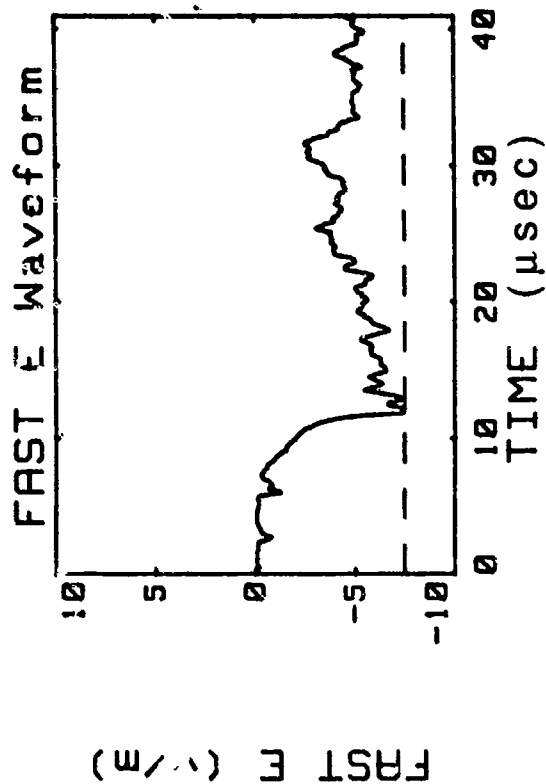
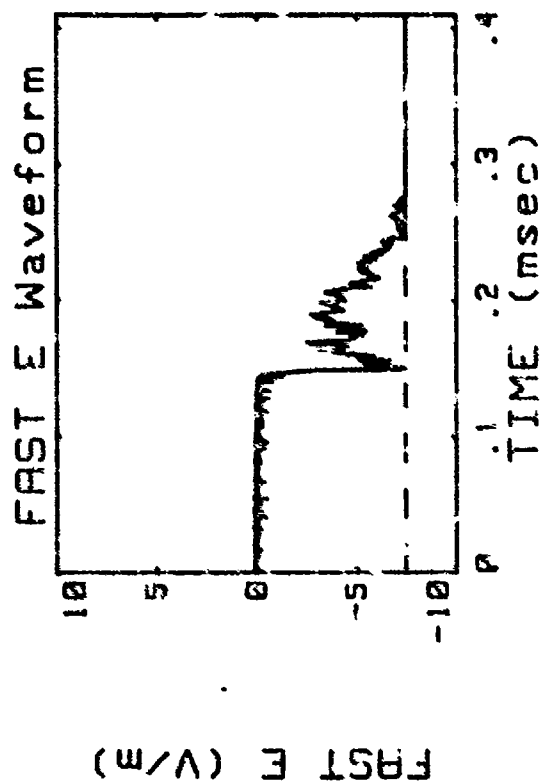


19:37:24.715 8 Aug 1985 (11.6 Km)

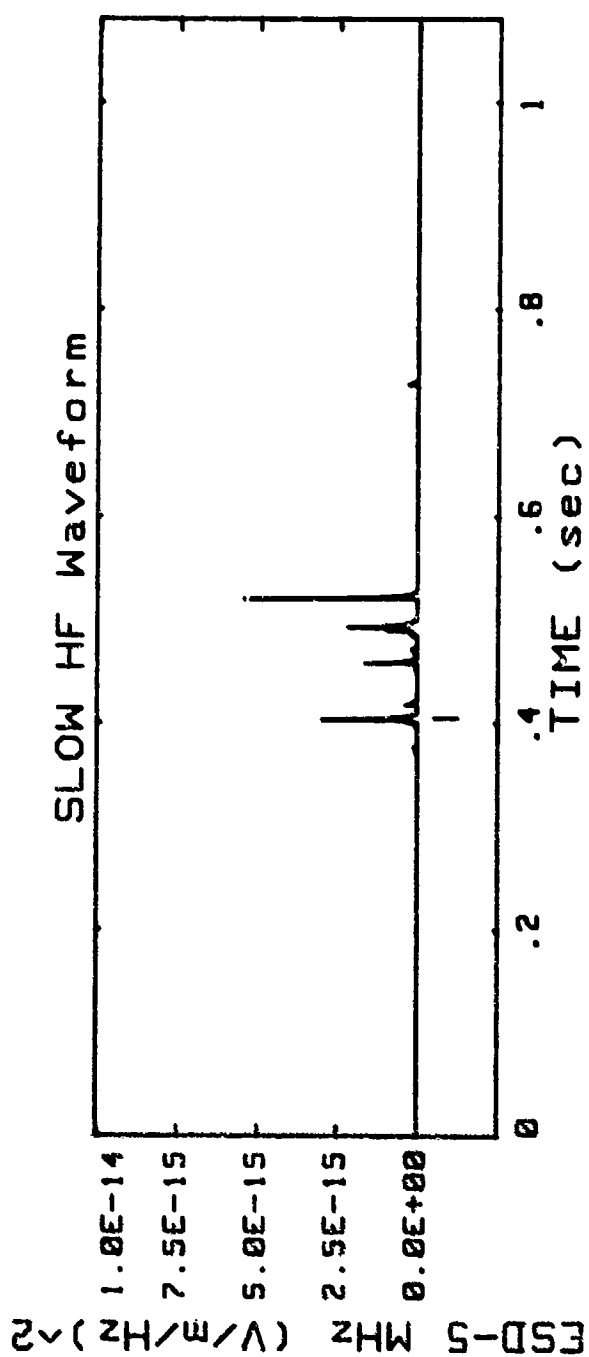
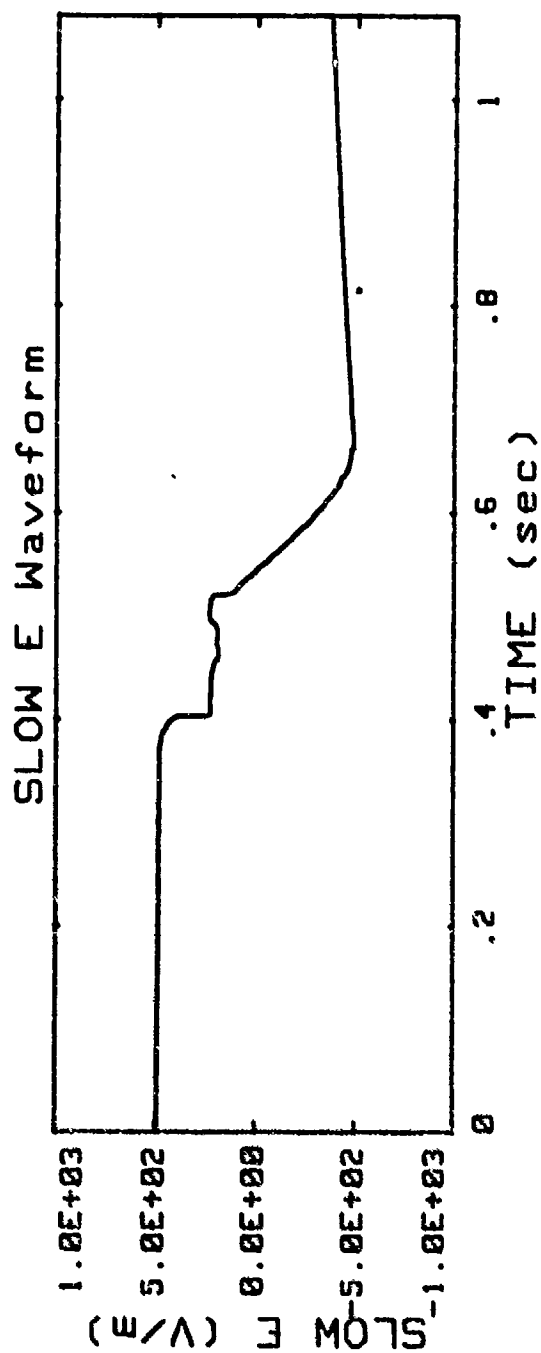


220193738.196 1985

1st RS (10.8 Km)

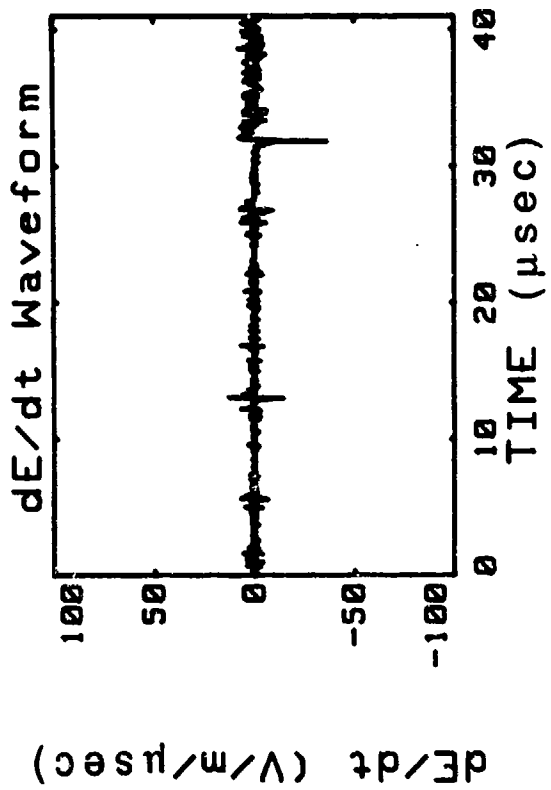
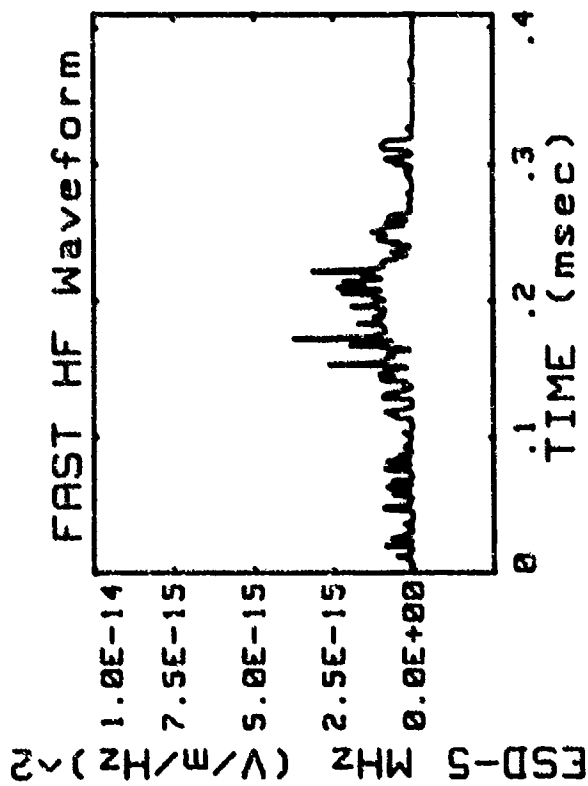
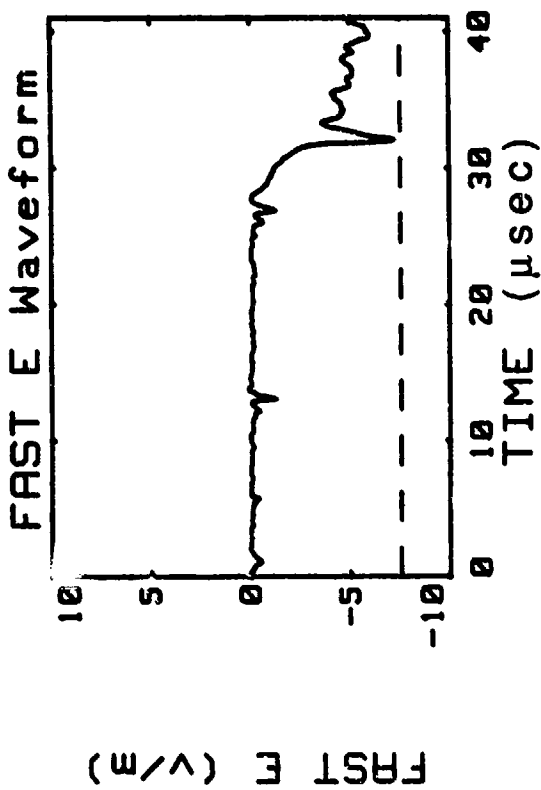
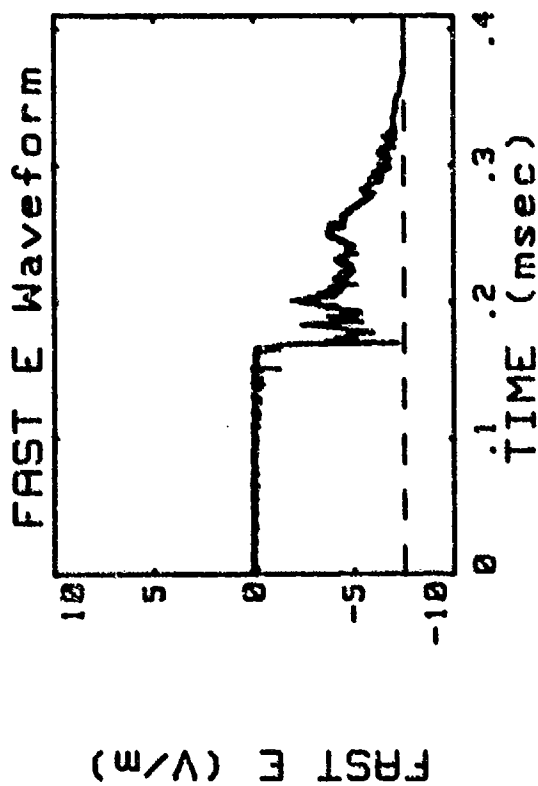


19:37:37.804 8 Aug 1985 (10.8 Km)



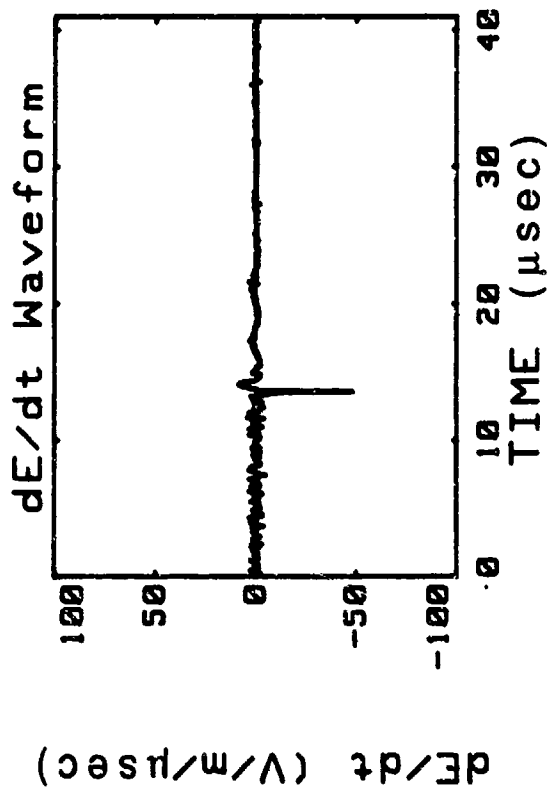
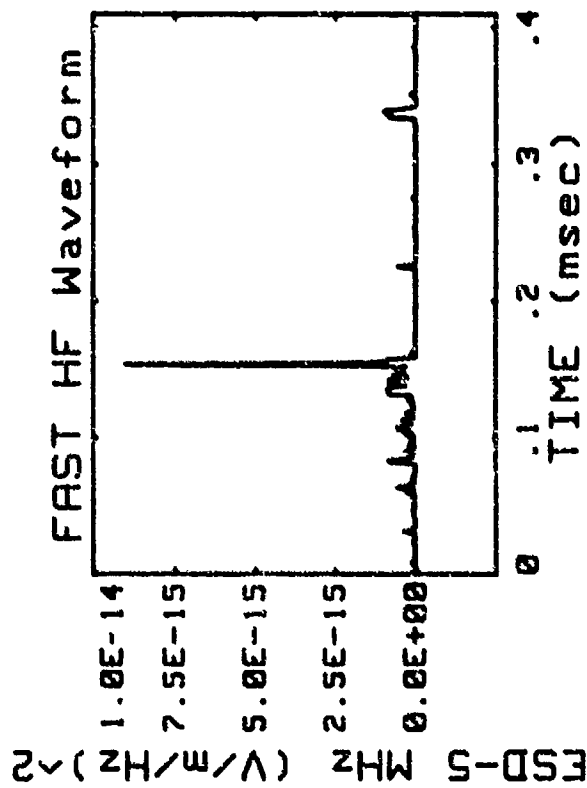
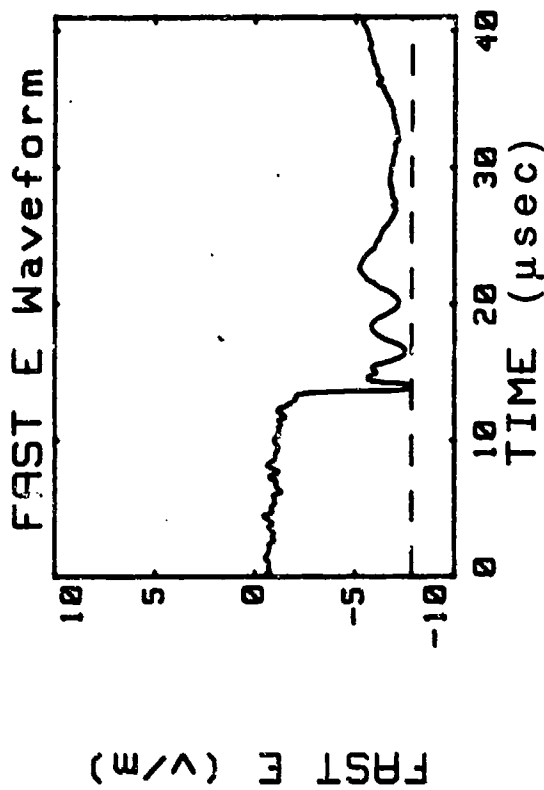
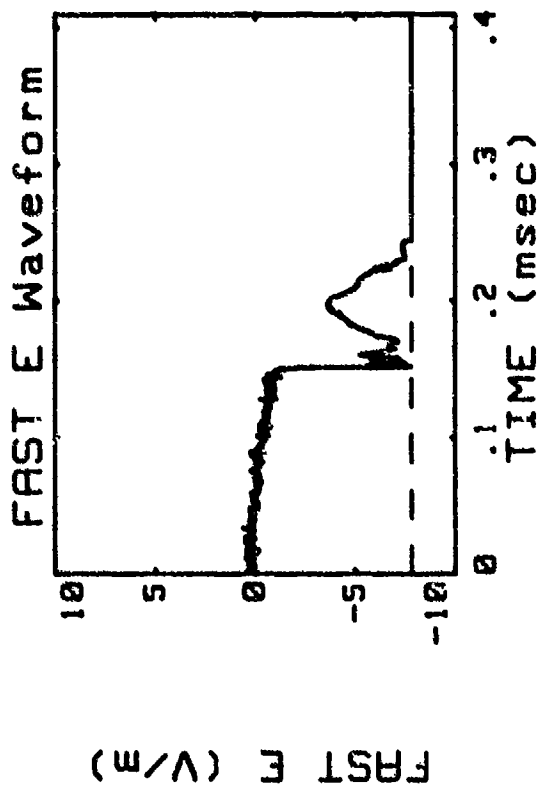
220193822.166 1985

1st RS (10.4 Km)

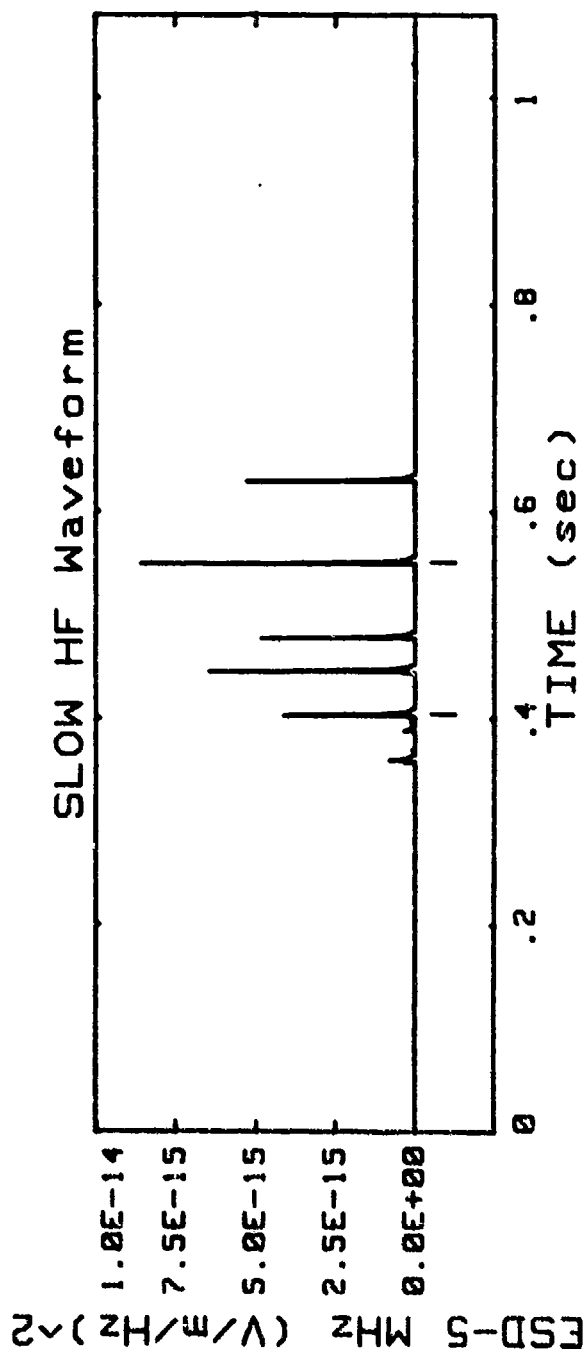
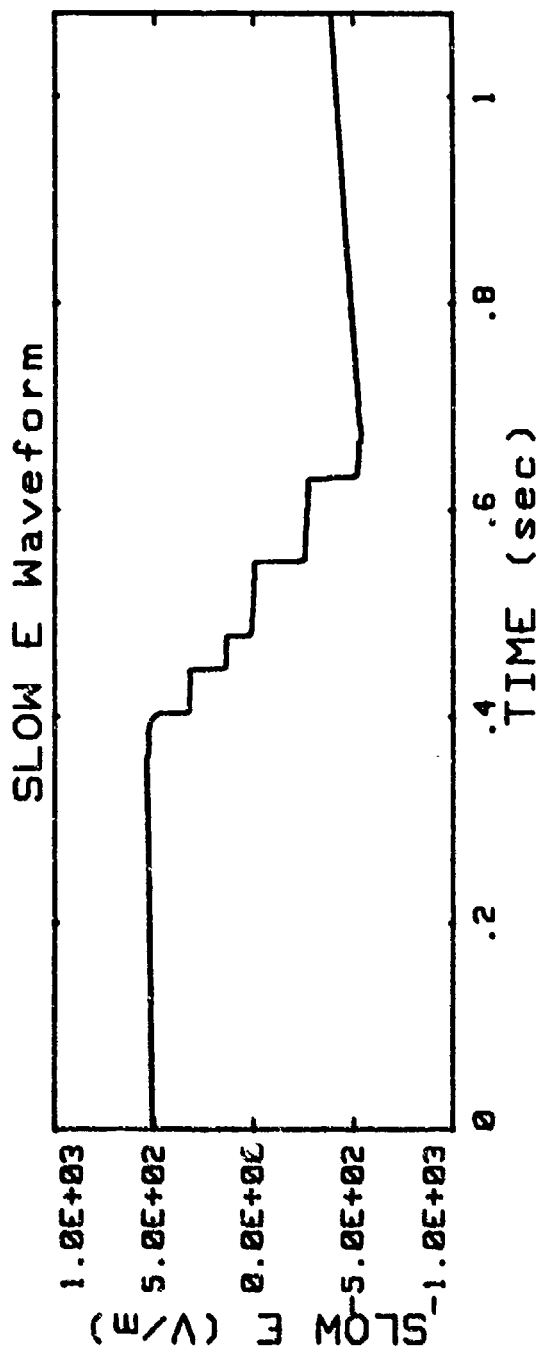


220193822.313 1985

Chaotic Subs RS (10.4 Km)

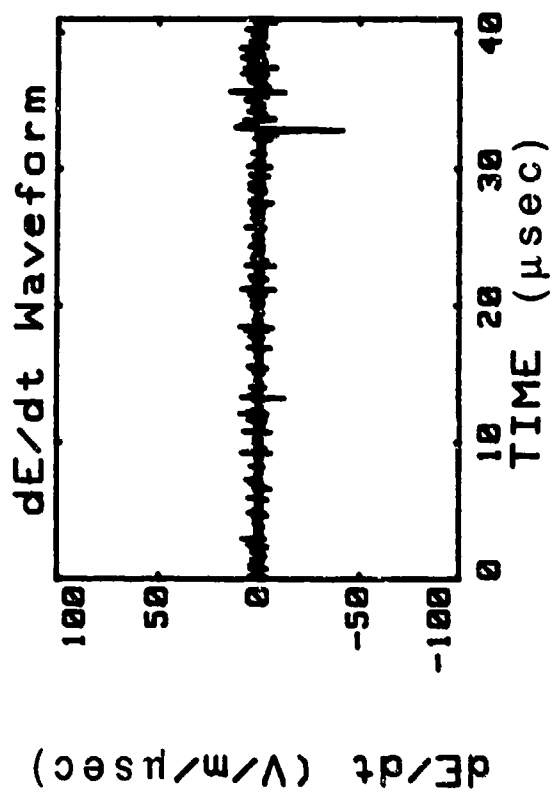
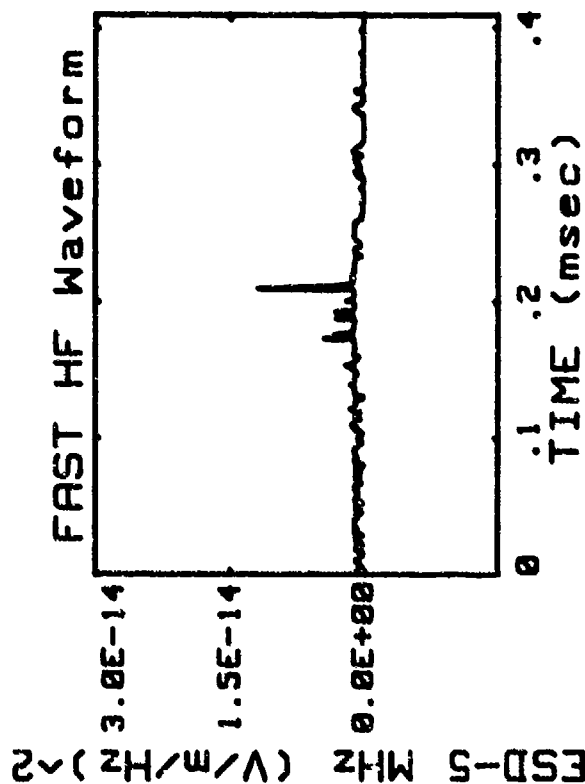
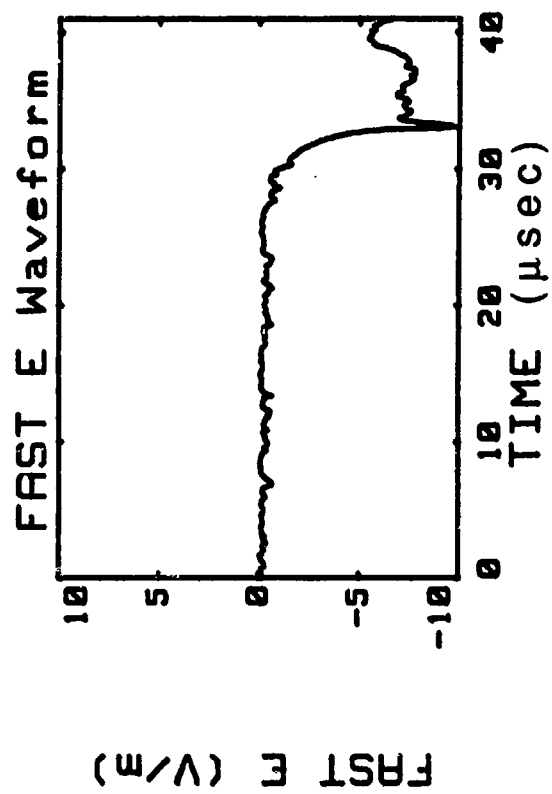
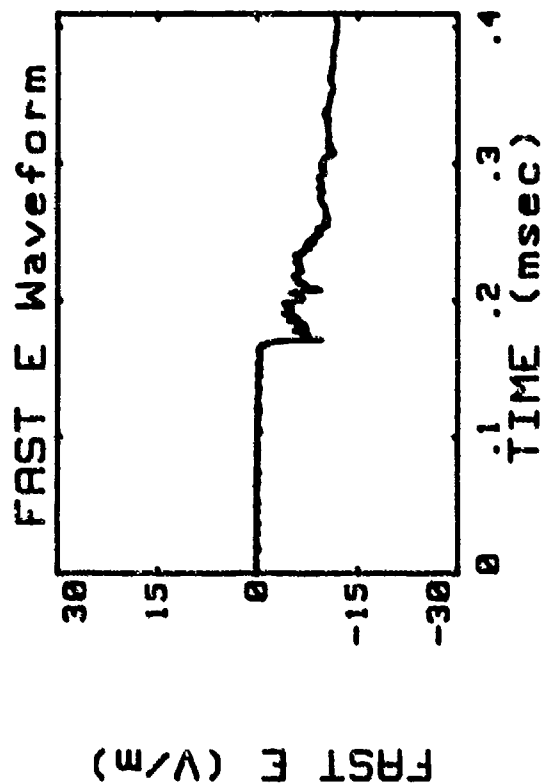


19:38:21.774 8 Aug 1985 (10.4 Km)

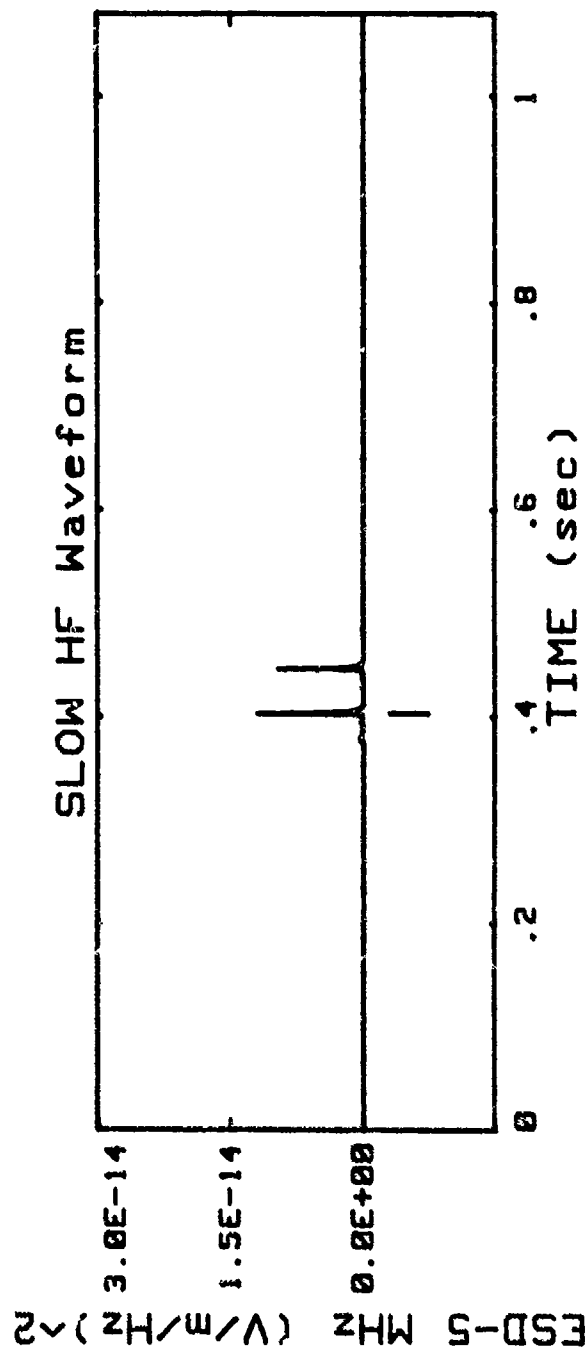
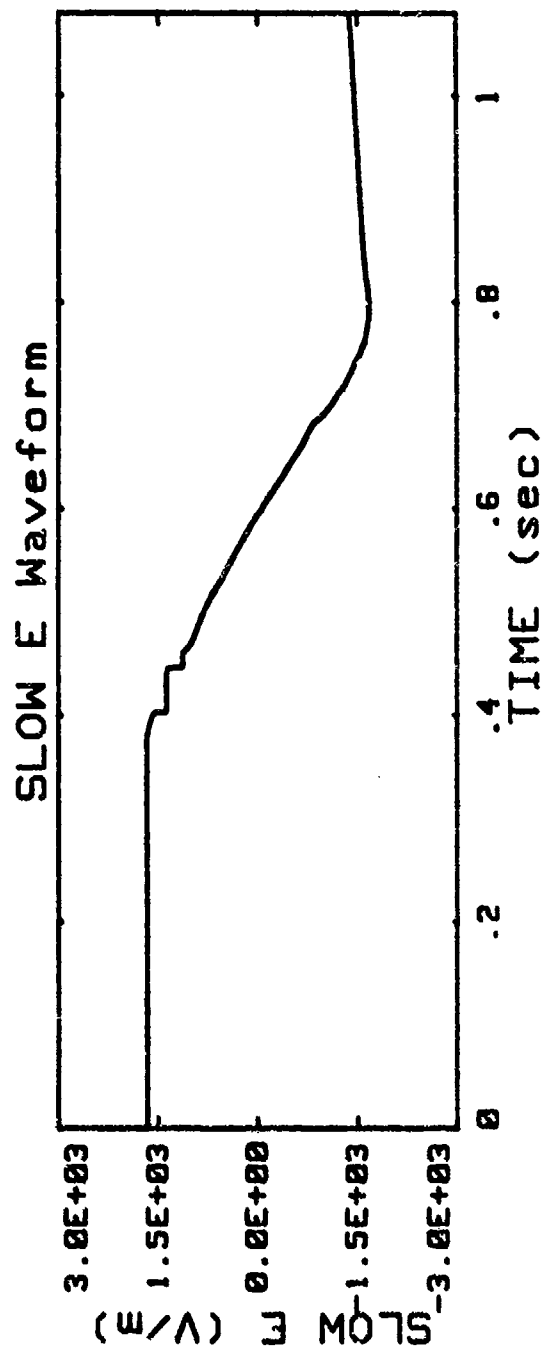


220193845.923 1985

1st RS (11.4 Km)

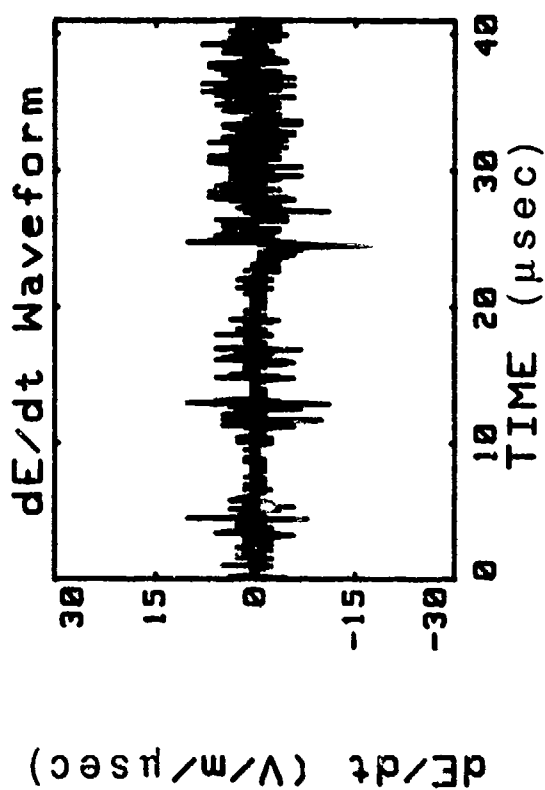
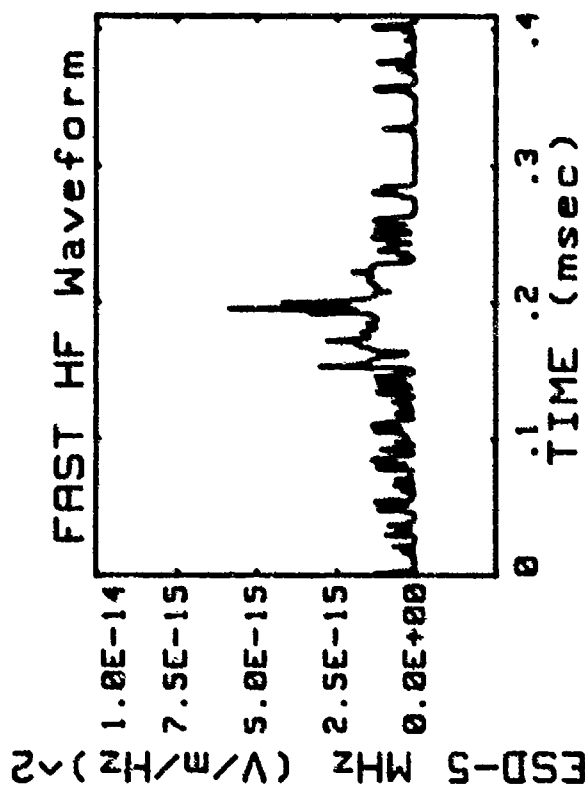
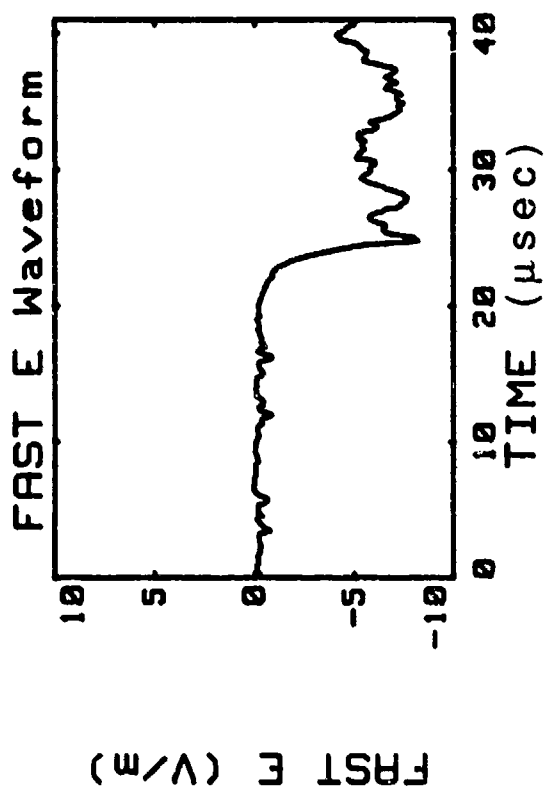
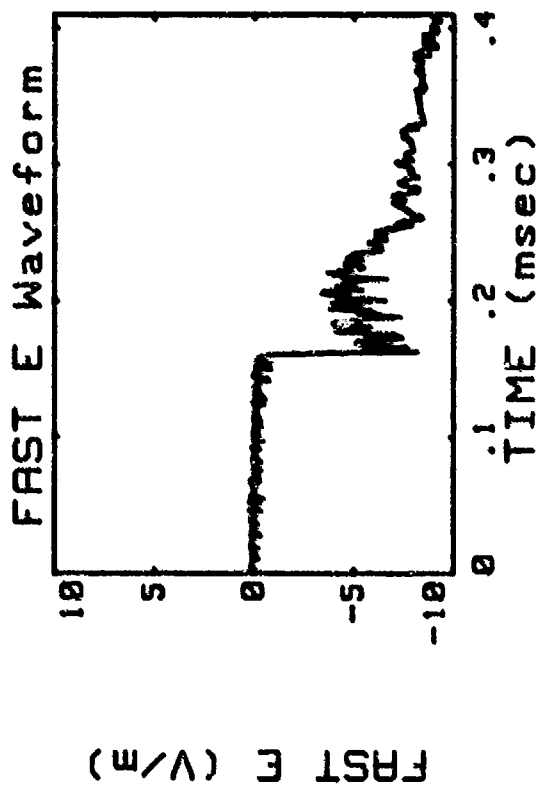


19:38:45.532 8 Aug 1985 (11.4 Km)

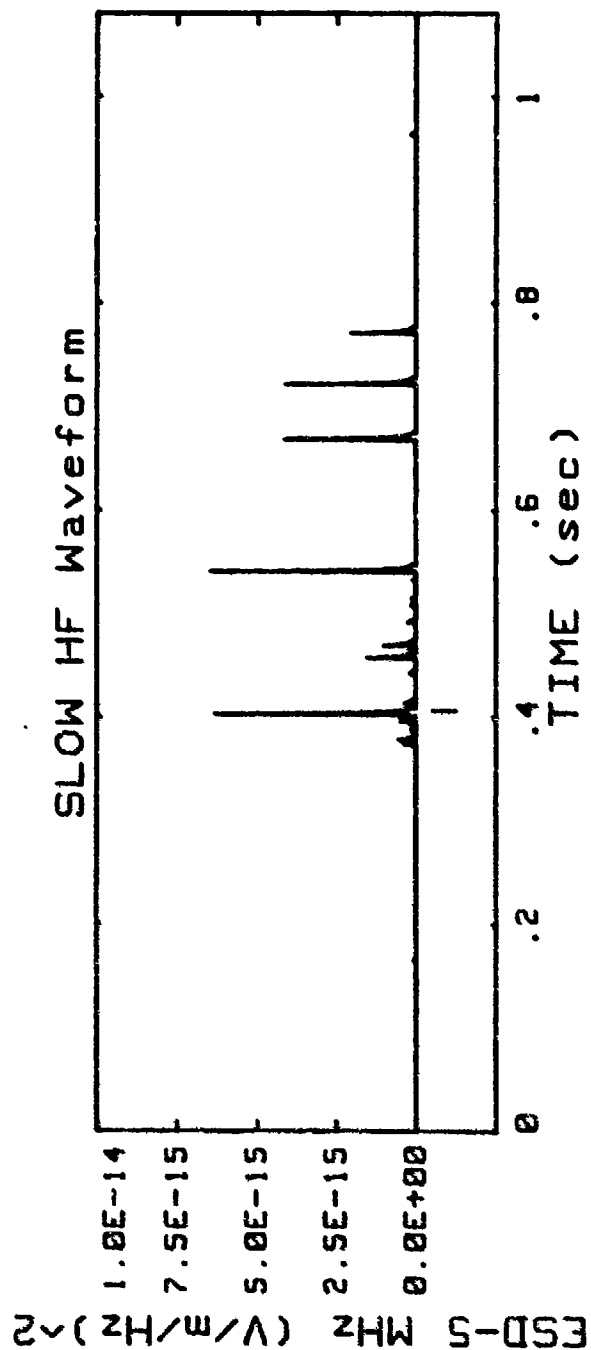
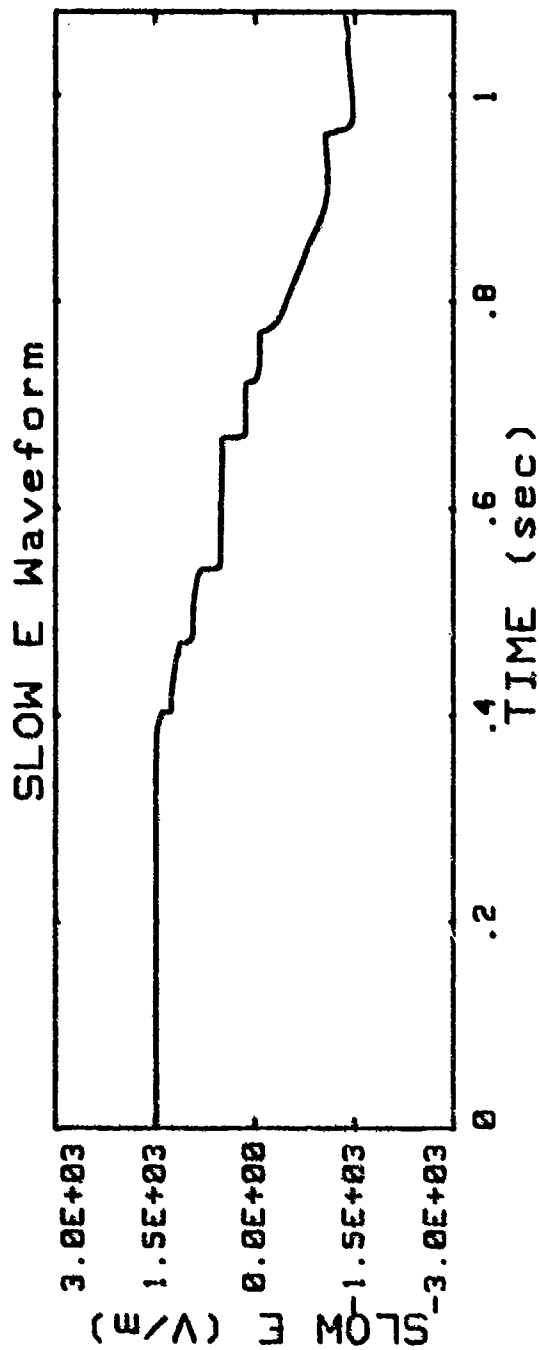


220193909.645 1985

1st RS (12.4 Km)

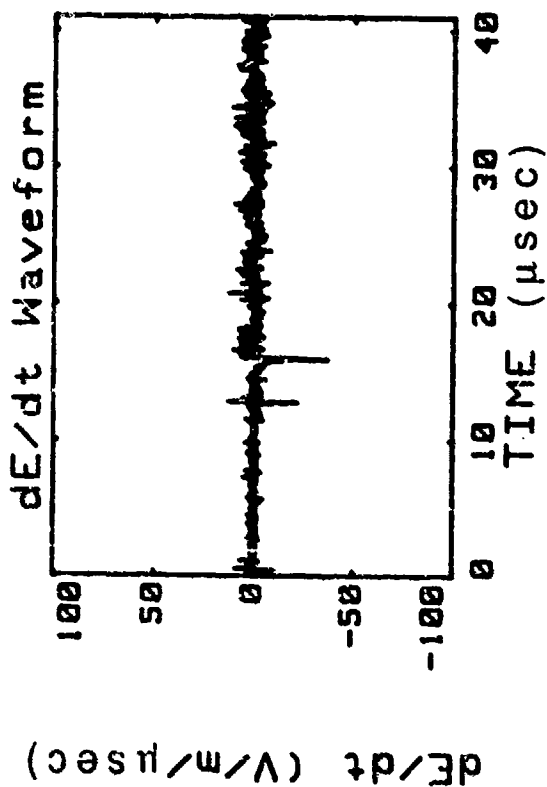
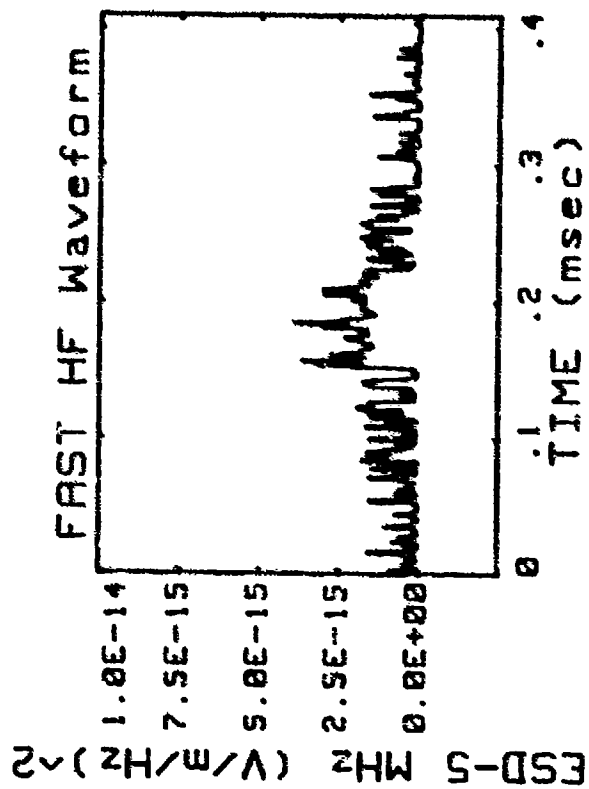
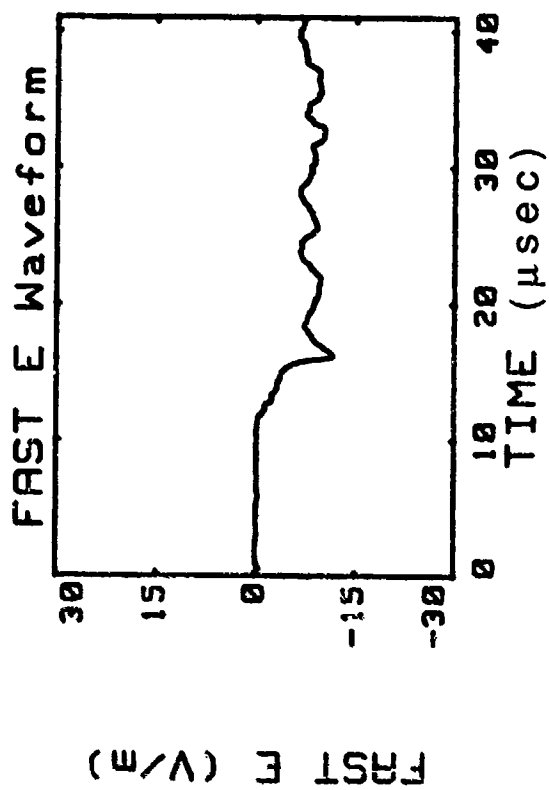
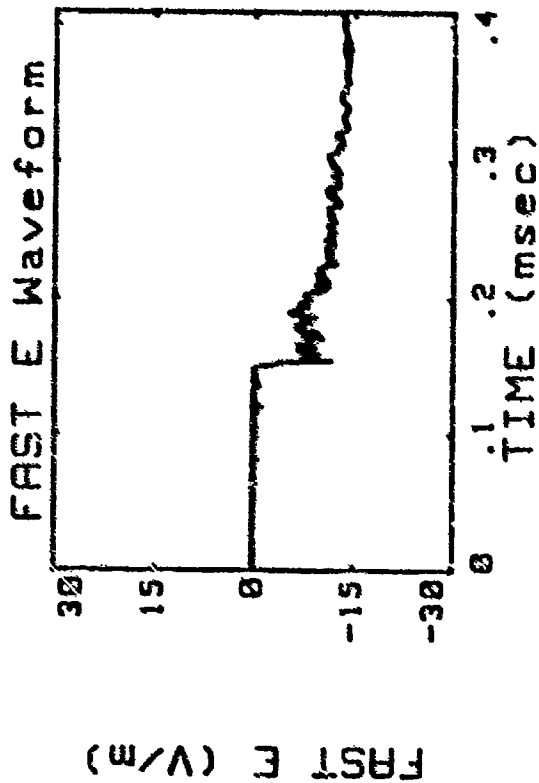


19:39:09.251 8 Aug 1985 (12.4 Km)

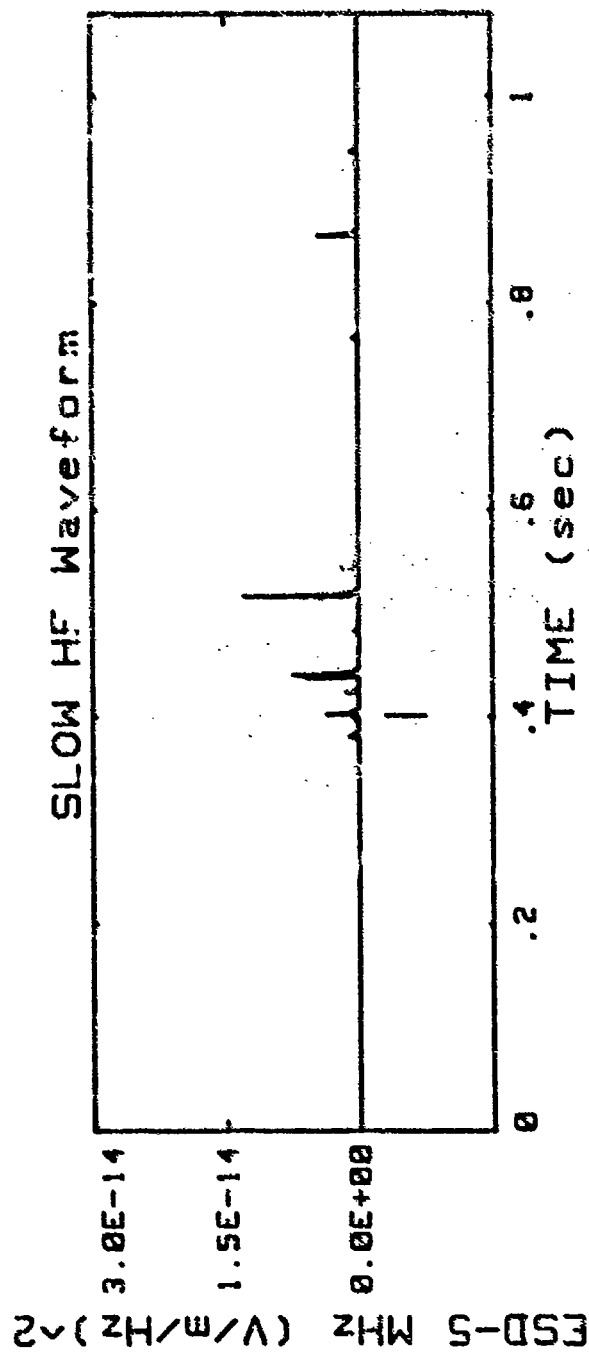
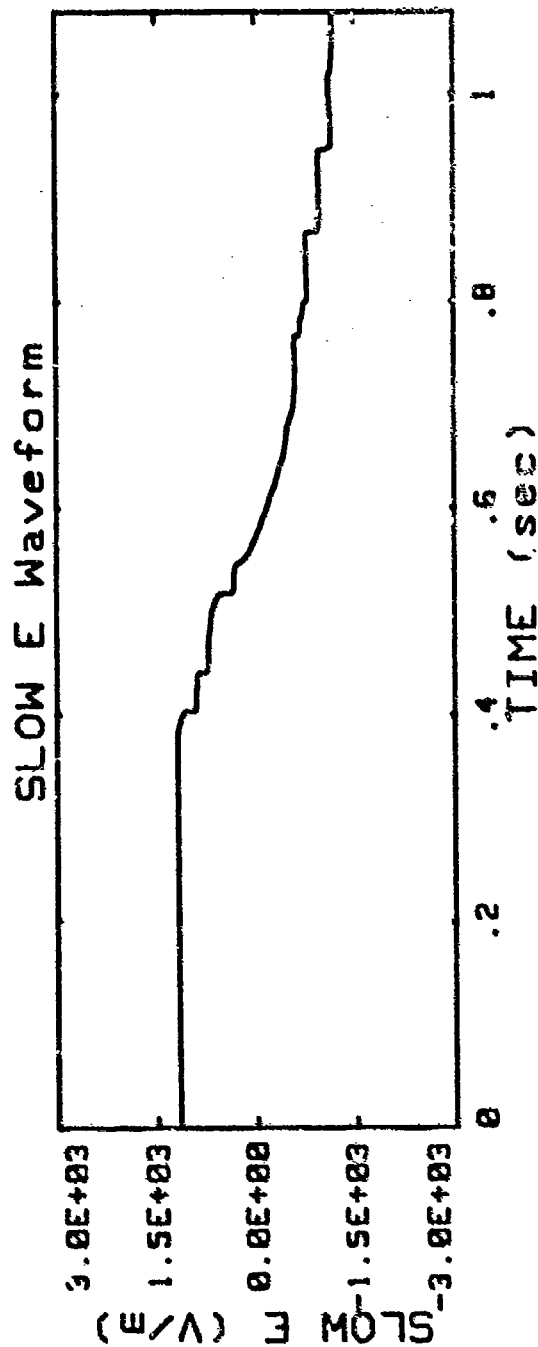


220193947.220 1985

1st RS (13.8 Km)

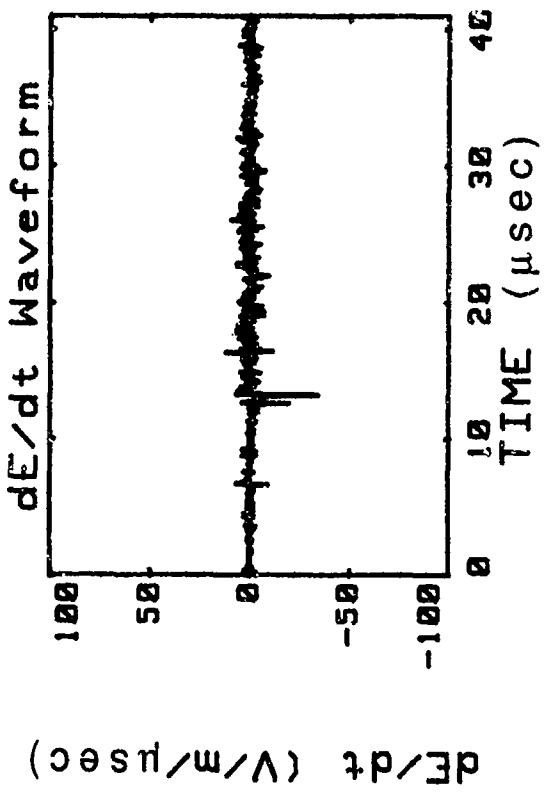
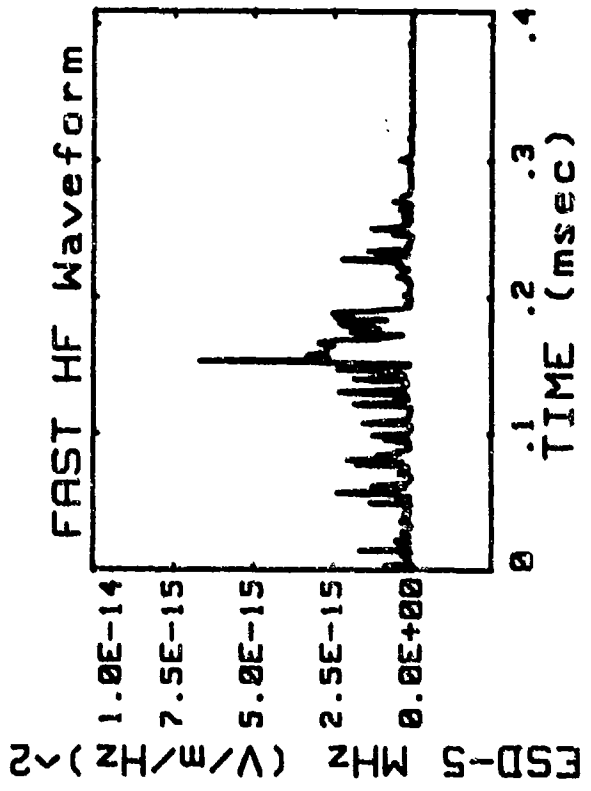
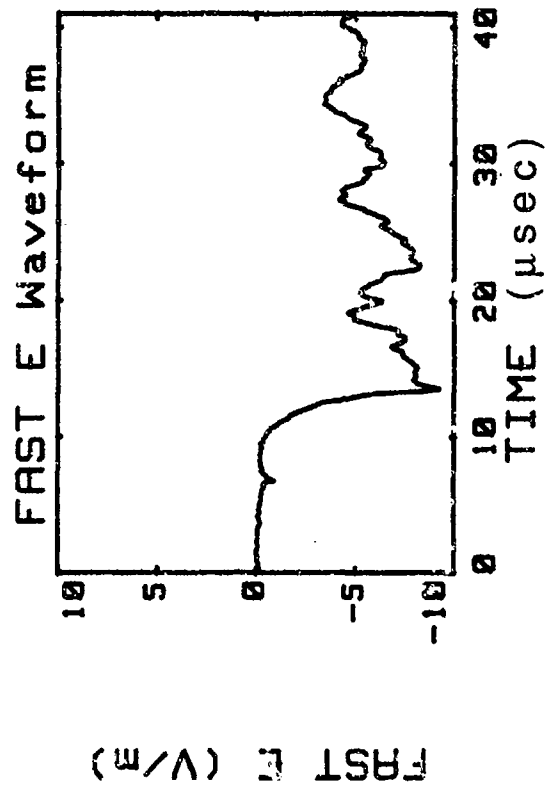
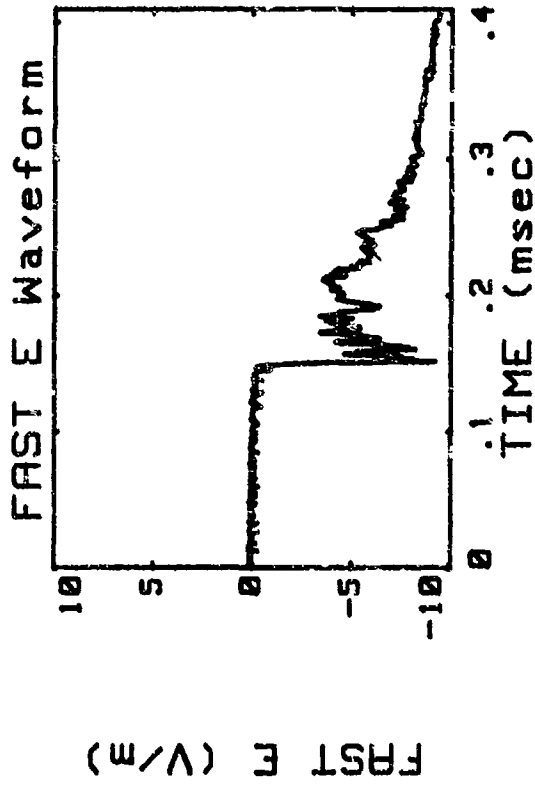


19:39:46.831 8 Aug 1985 (13.8 Km)

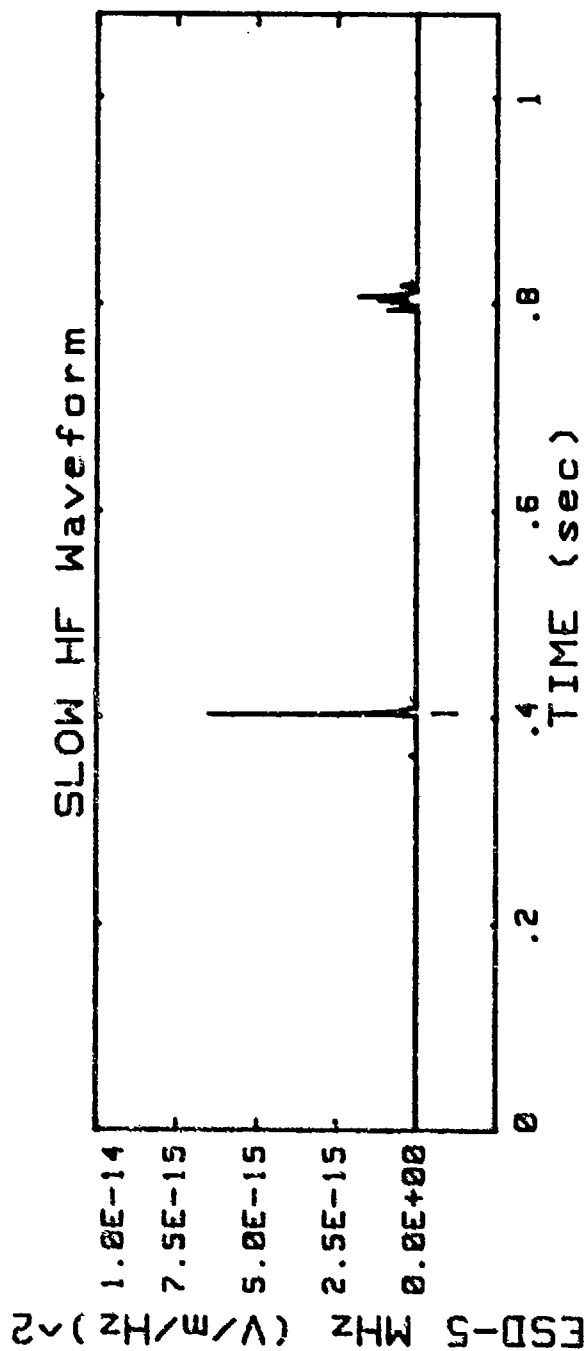
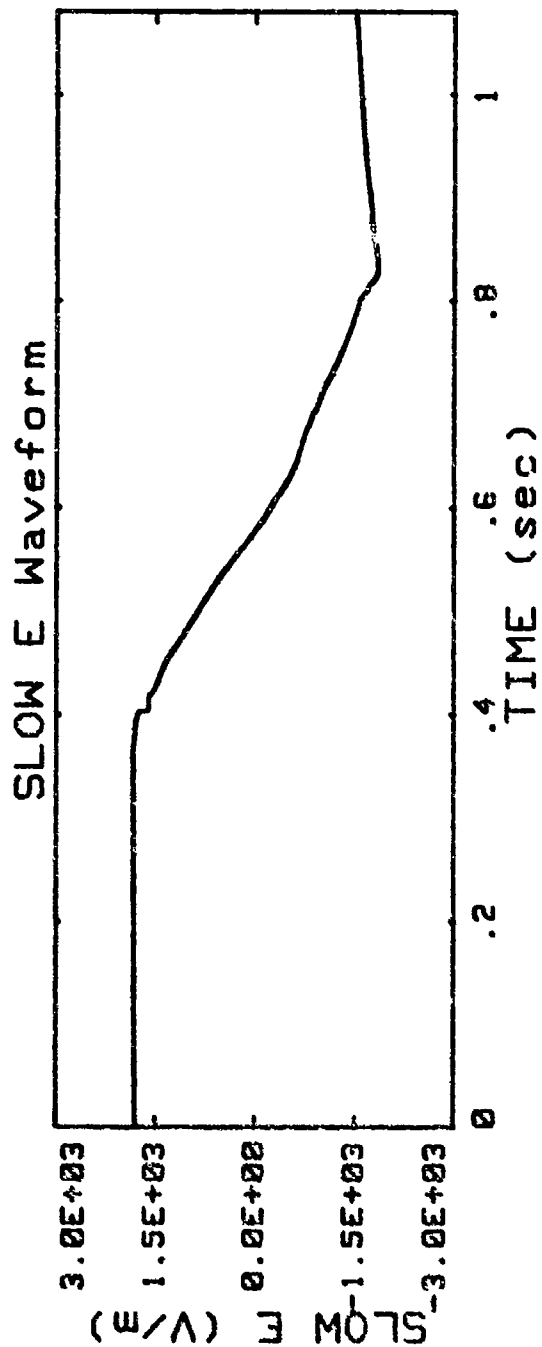


220194004.167 1985

1st RS (11.1 Km)

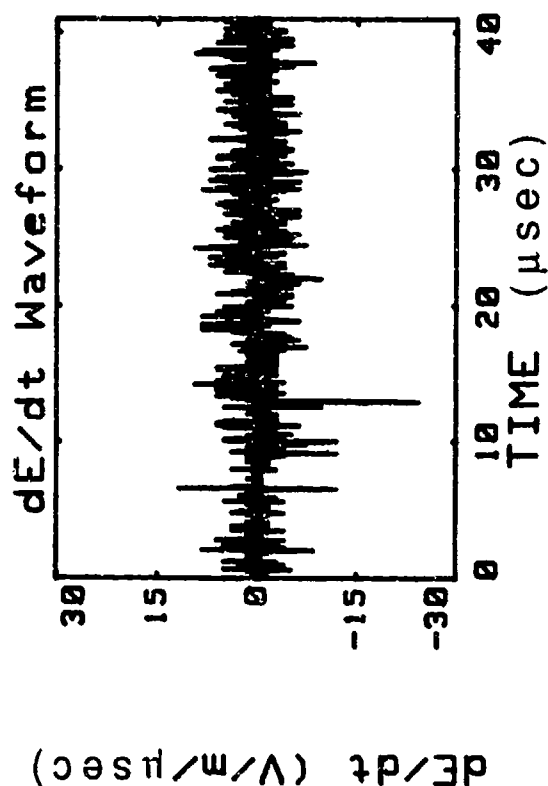
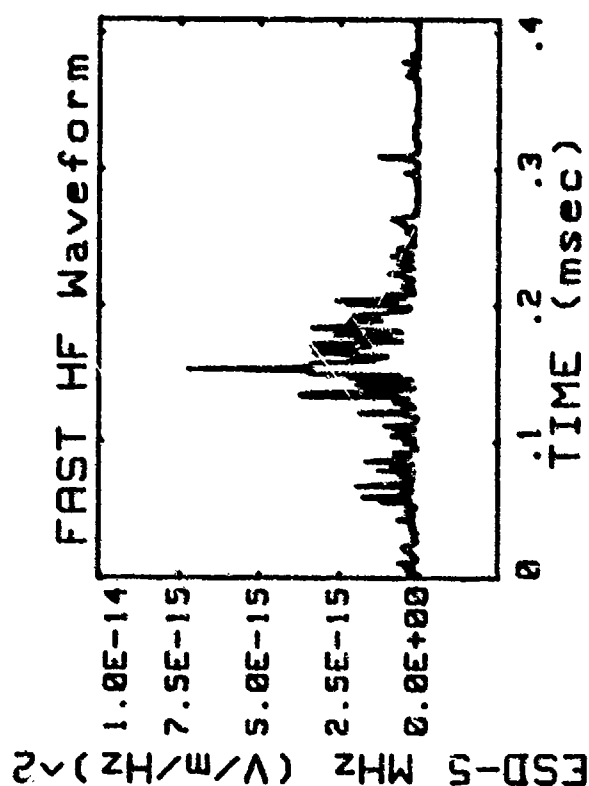
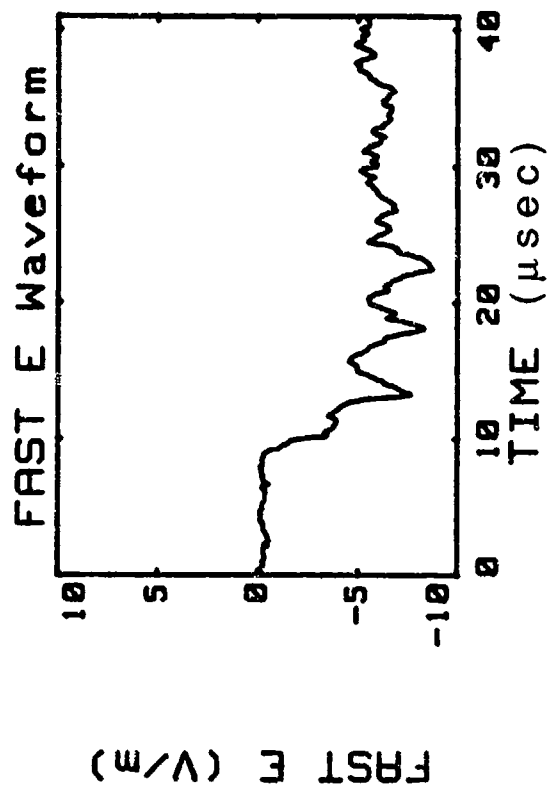
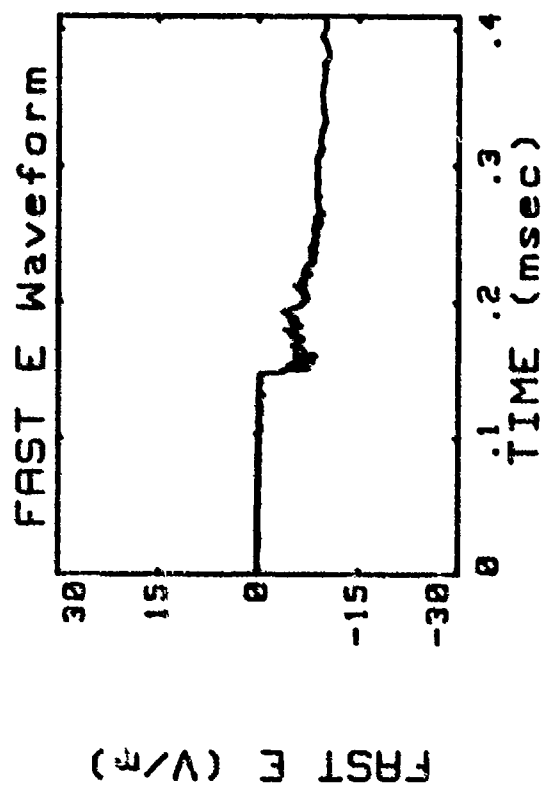


19:40:03.775 8 Aug 1985 (11.1 Km)



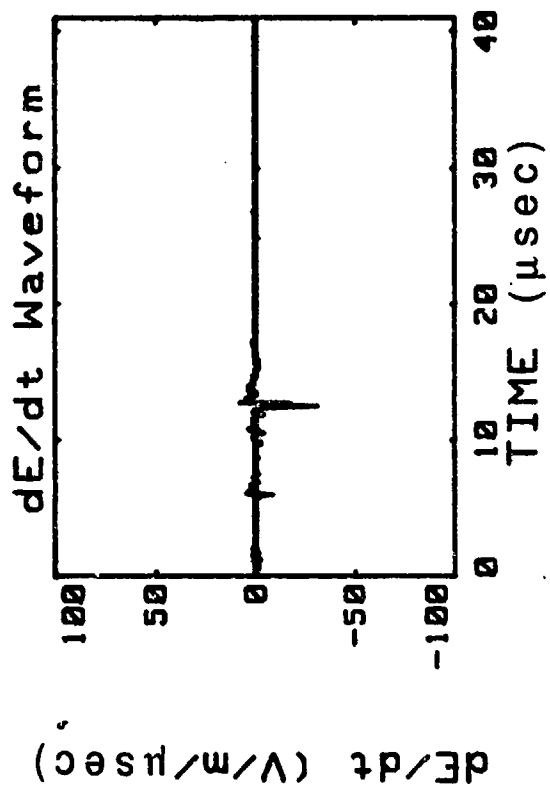
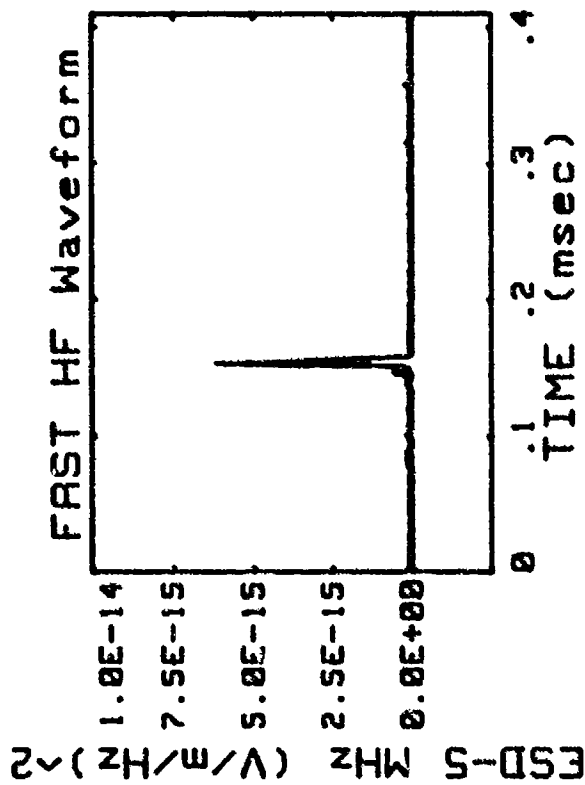
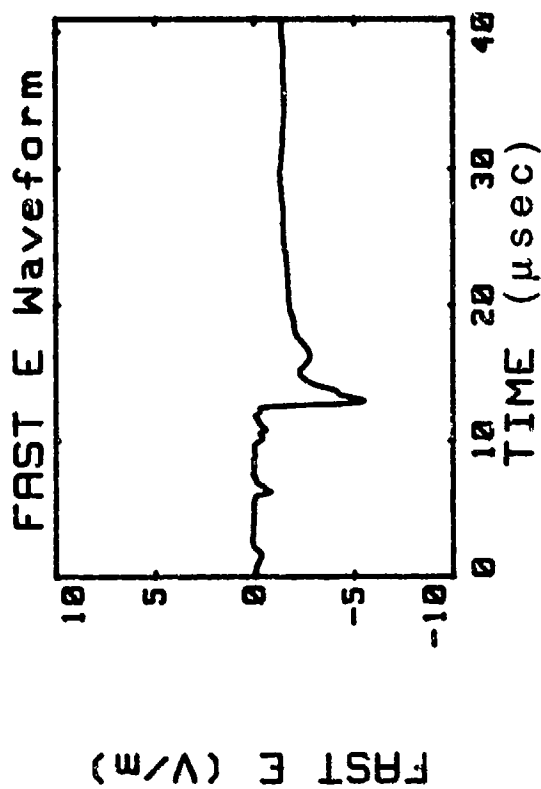
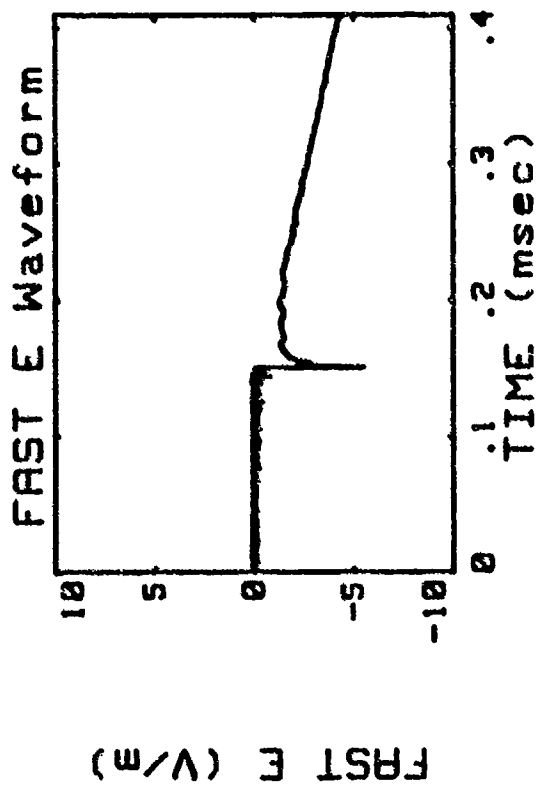
220194037.523 1985

1st RS (13 Km)

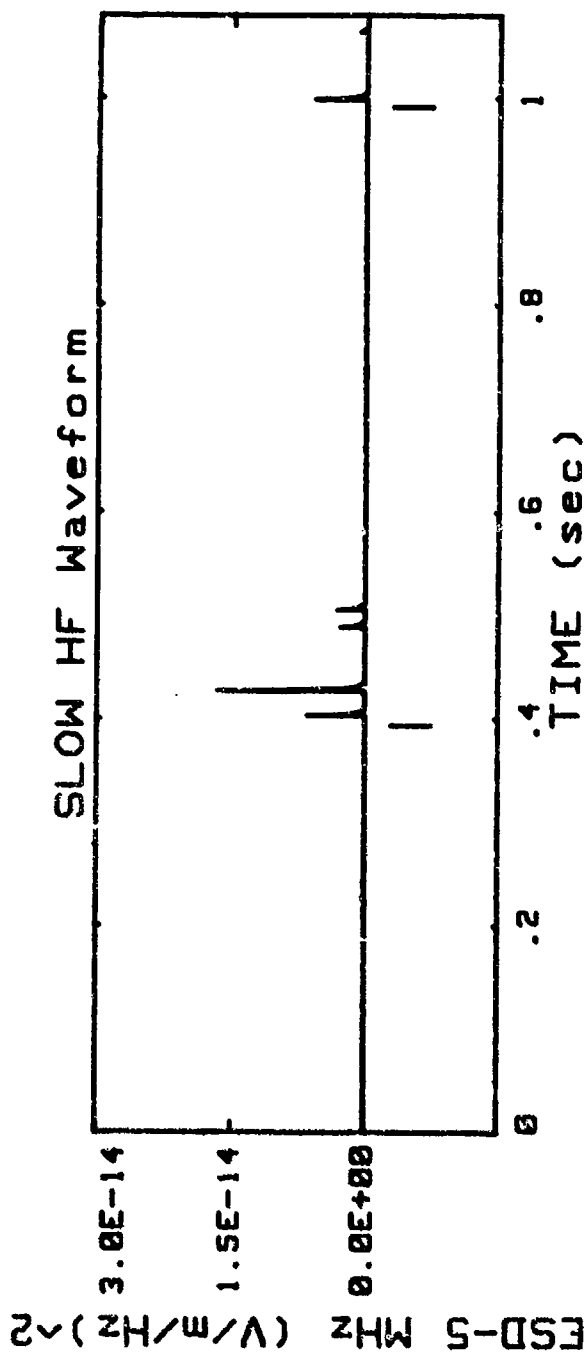
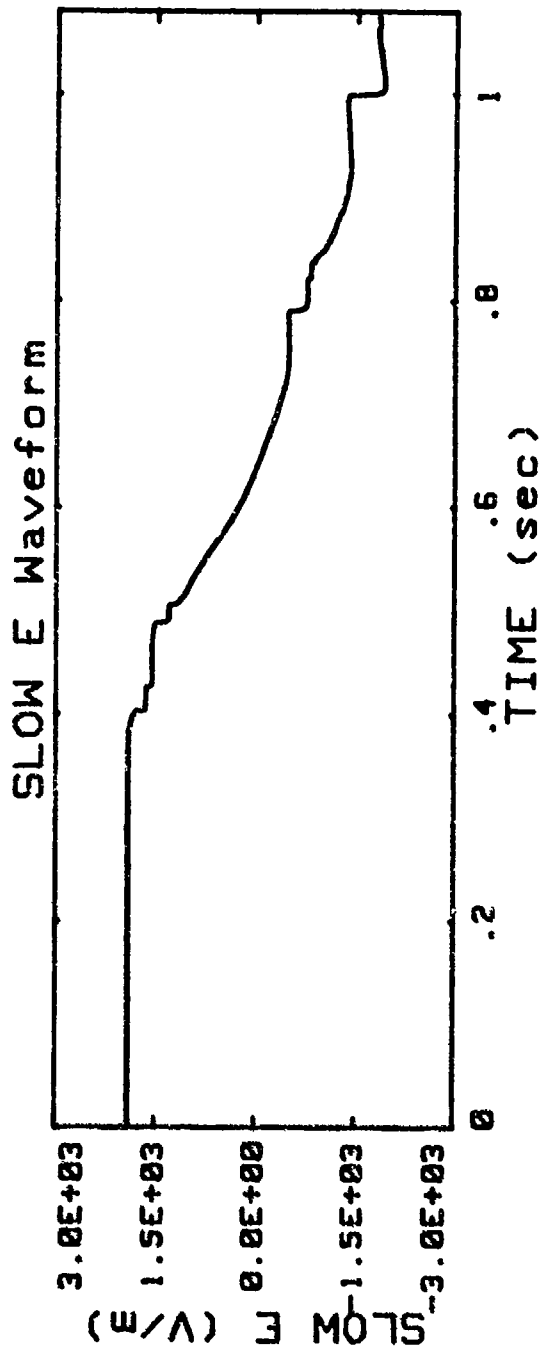


220194038.121 1985

DS Subs RS (13 Km)

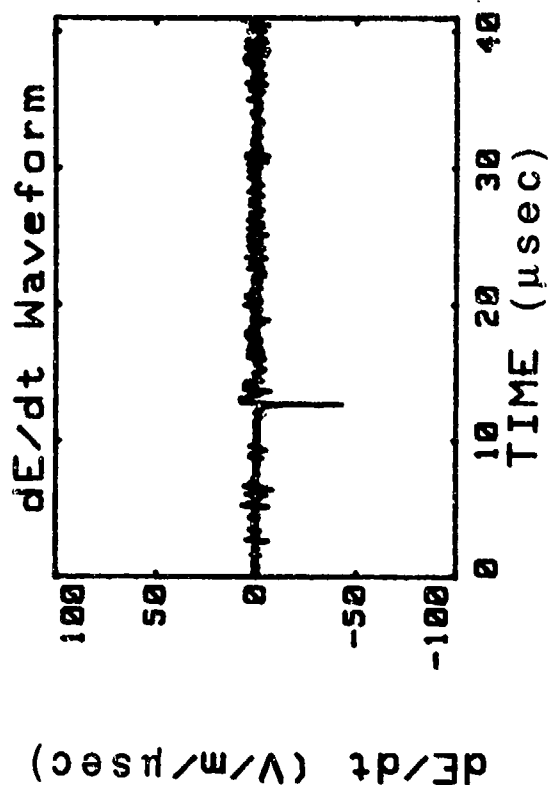
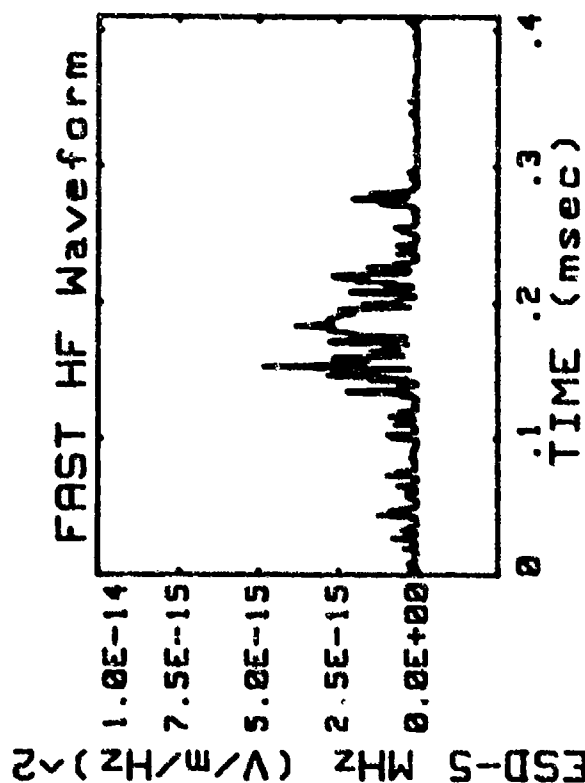
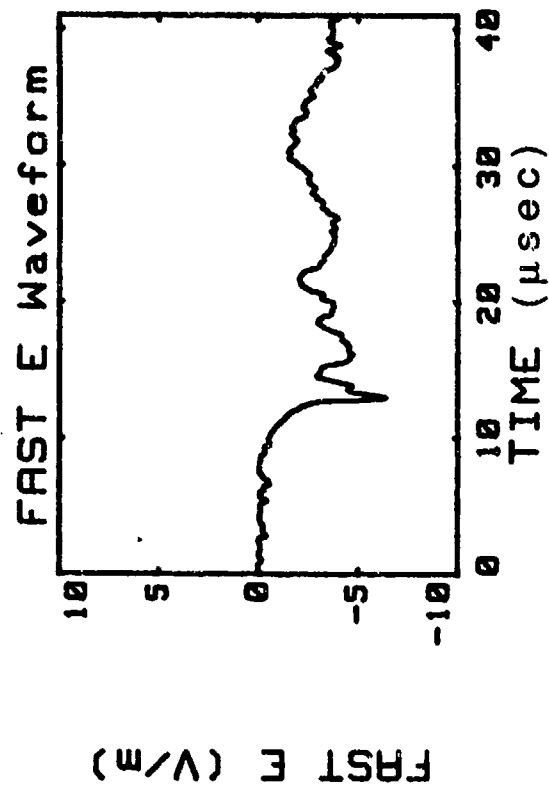
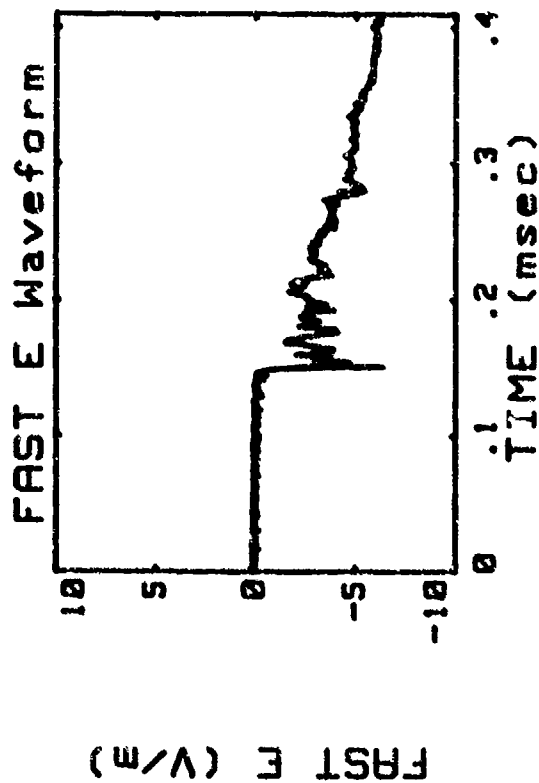


19:40:37.142 8 Aug 1985 (13 Km)

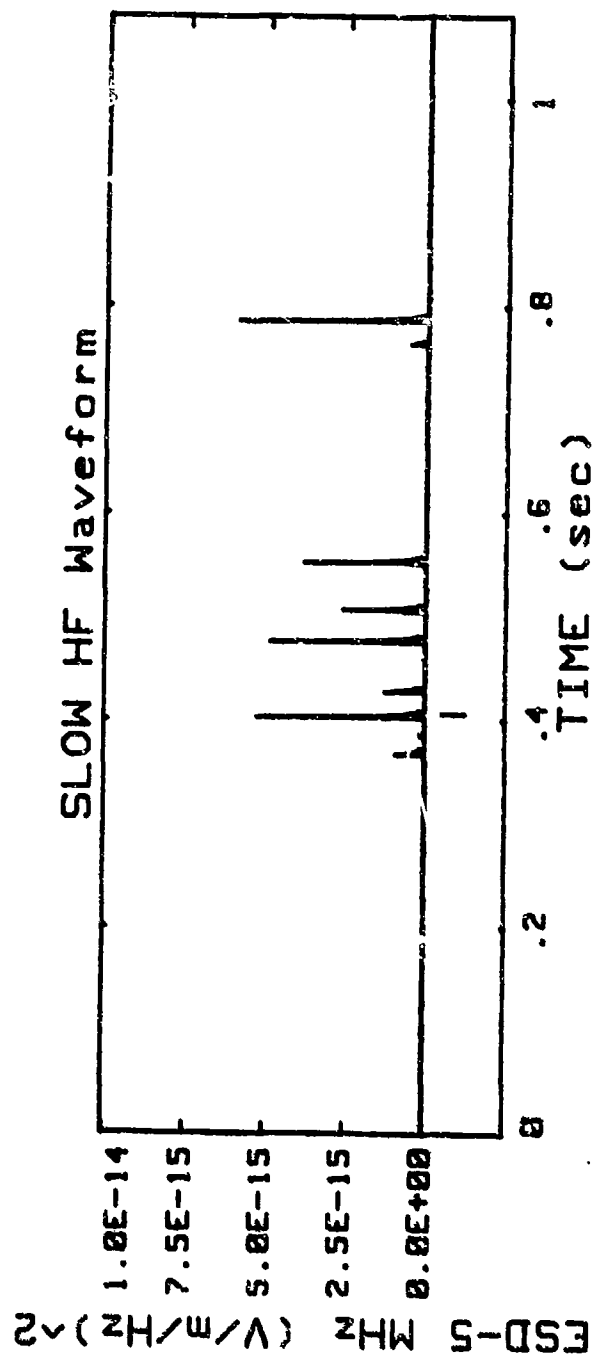
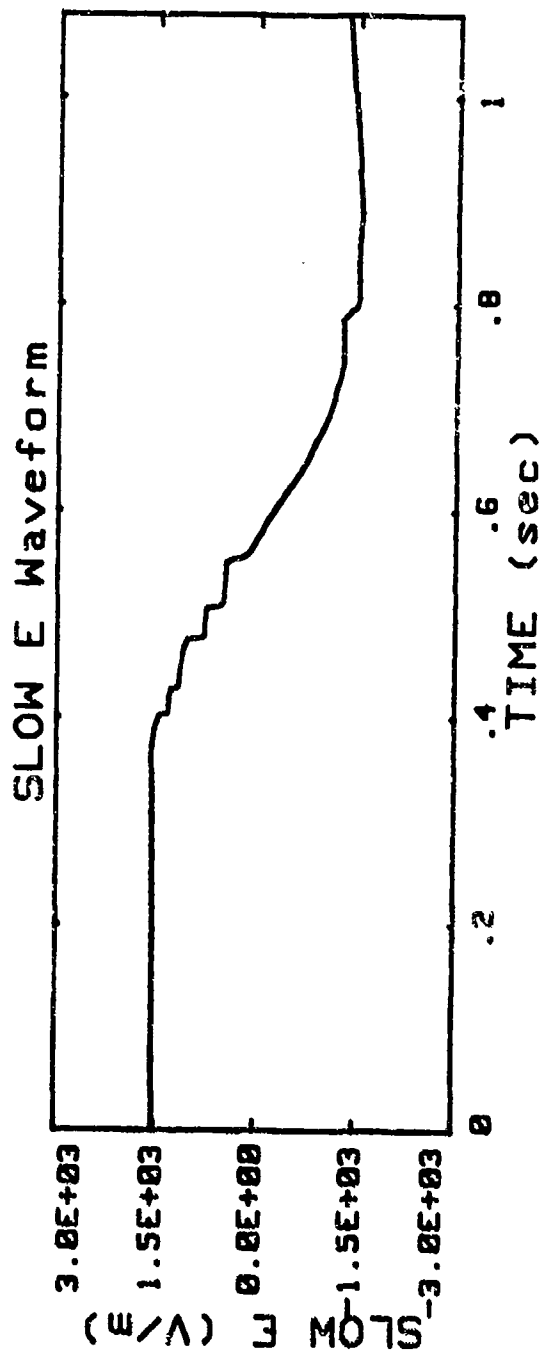


220194110.861 1985

1st RS (11.3 Km)

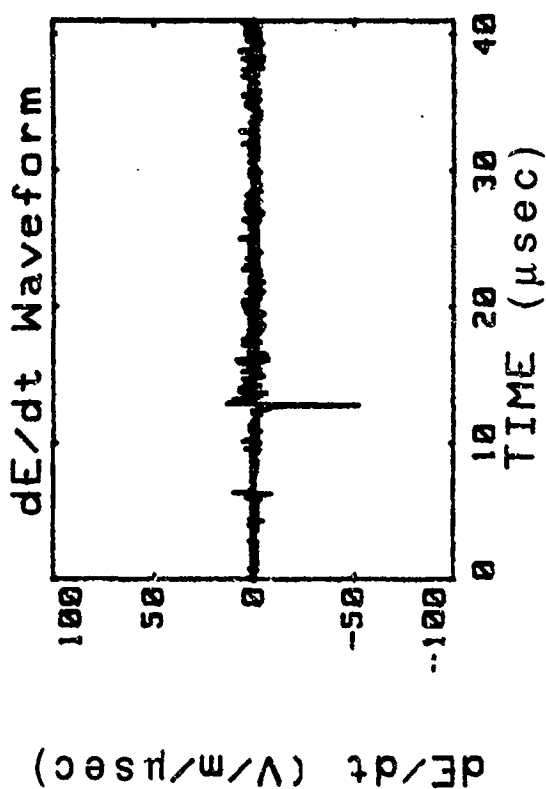
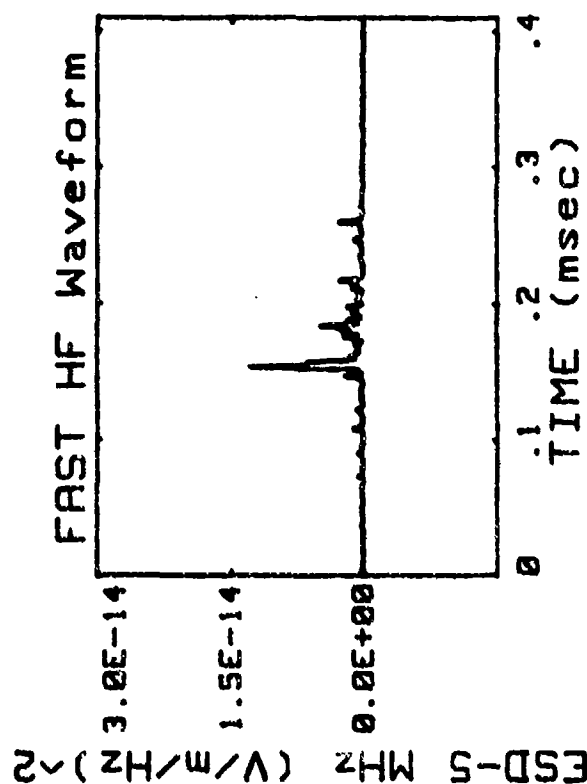
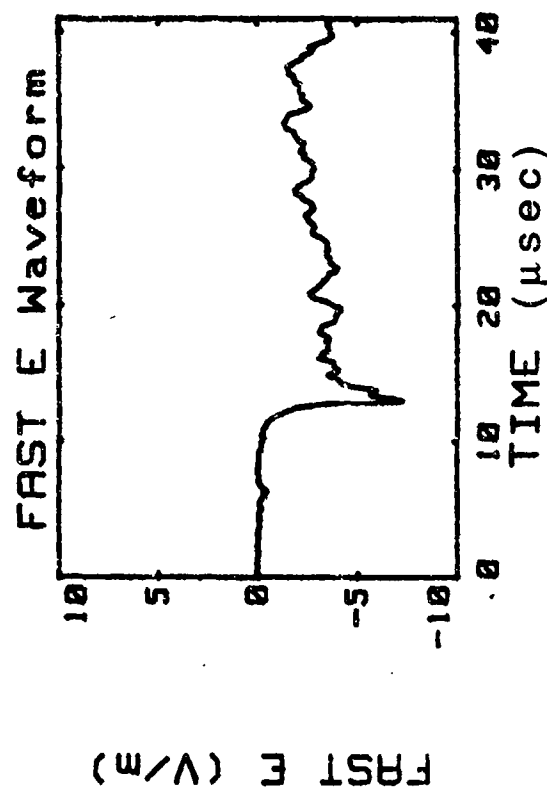
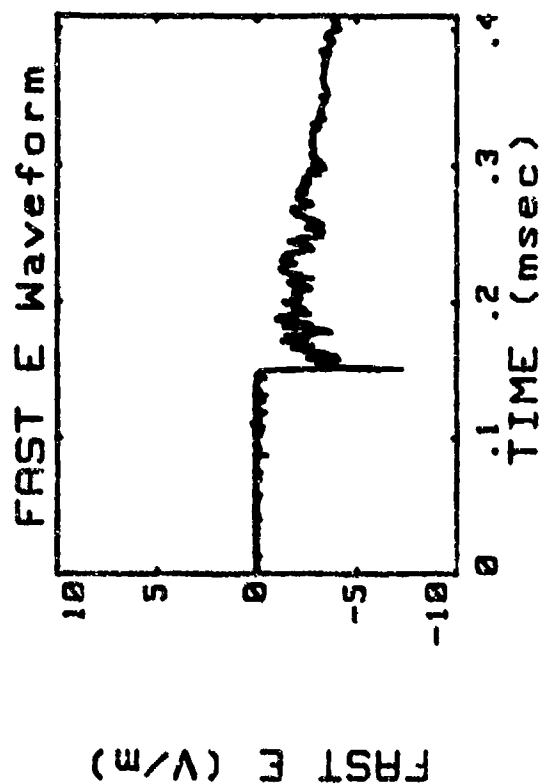


19:41:10.457 8 Aug 1985 (11.3 Km)

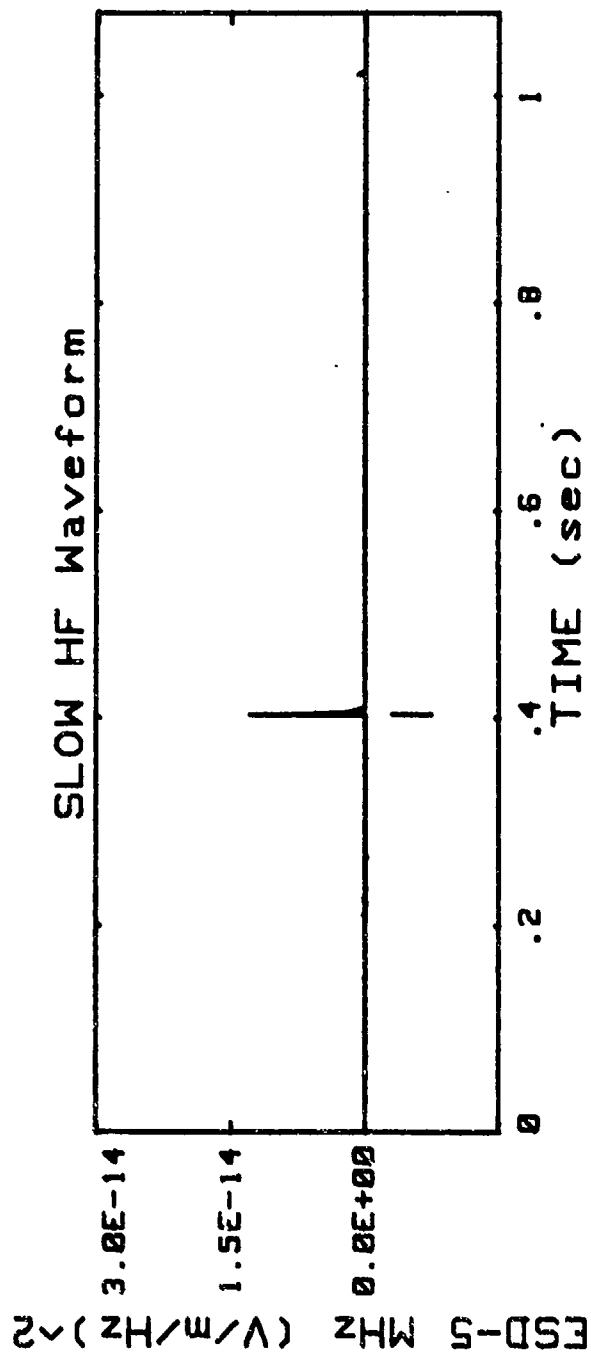
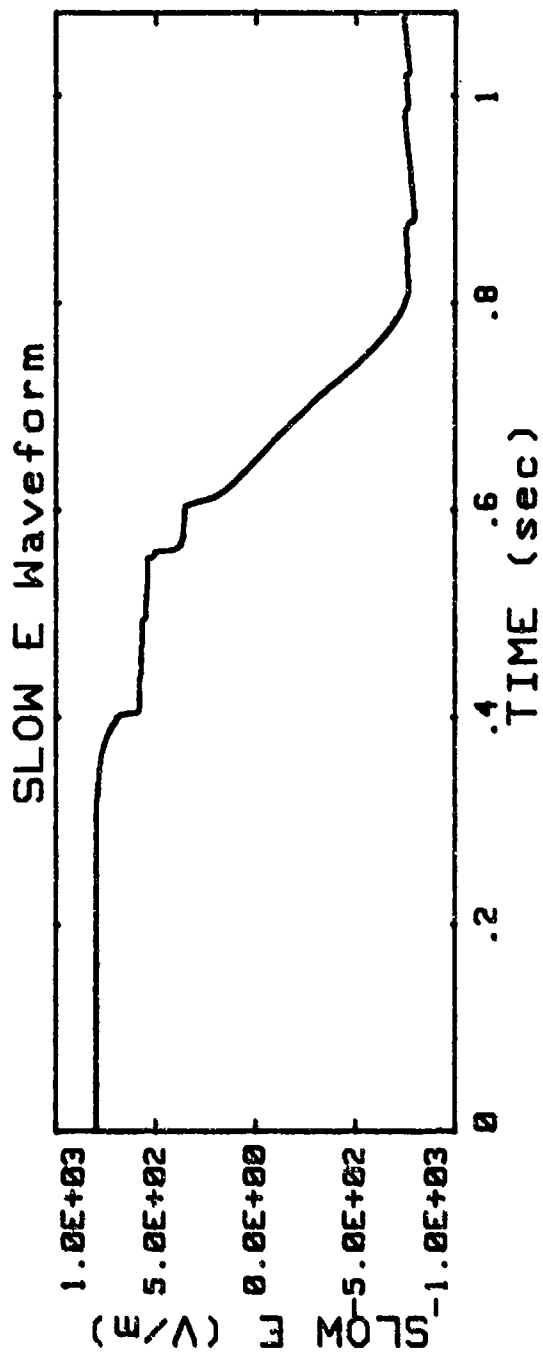


220194217.476 1985

1st RS (17.8 Km)

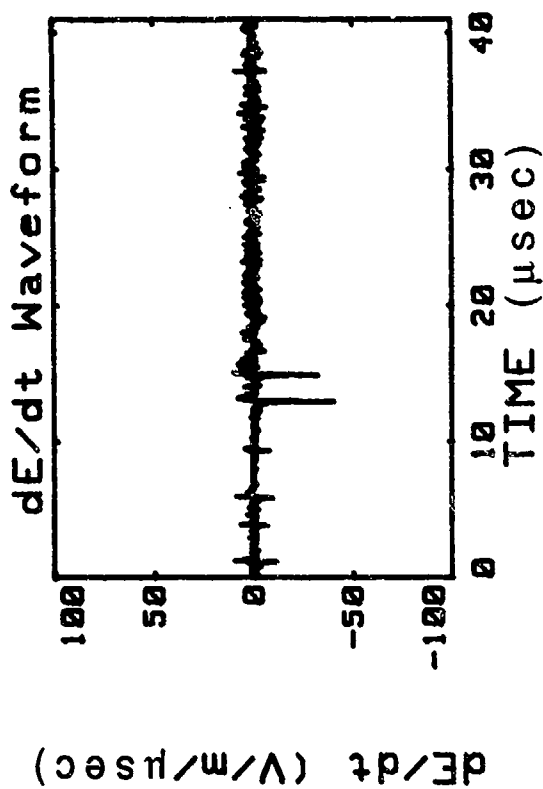
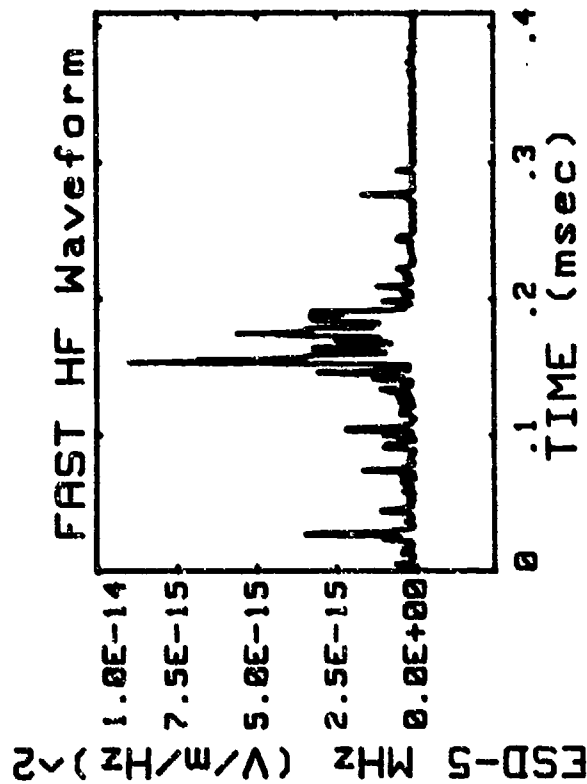
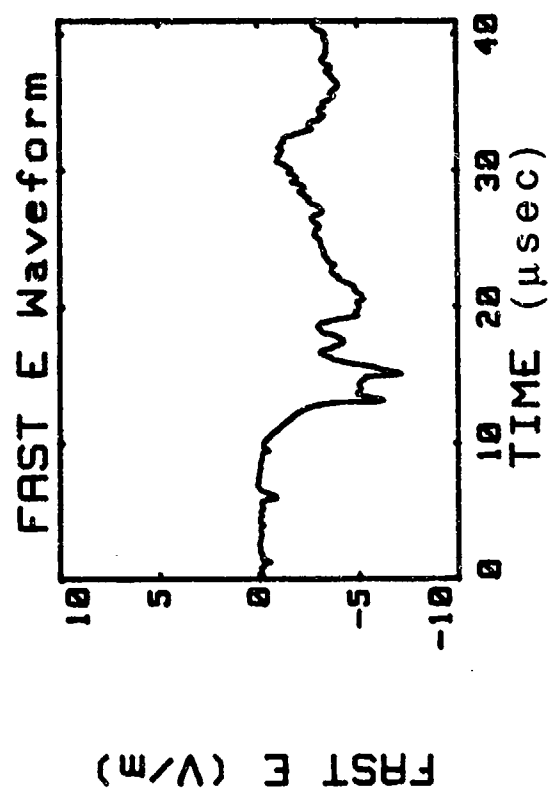
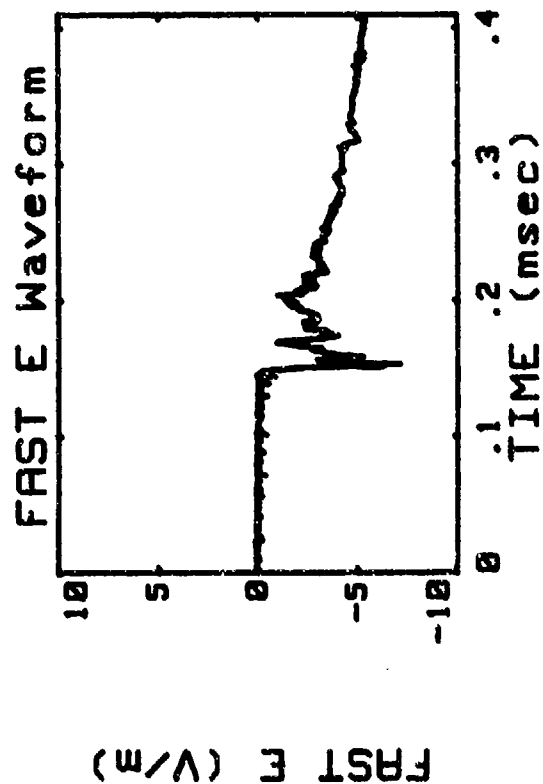


19:42:17.085 8 Aug 1985 (17.8 Km)

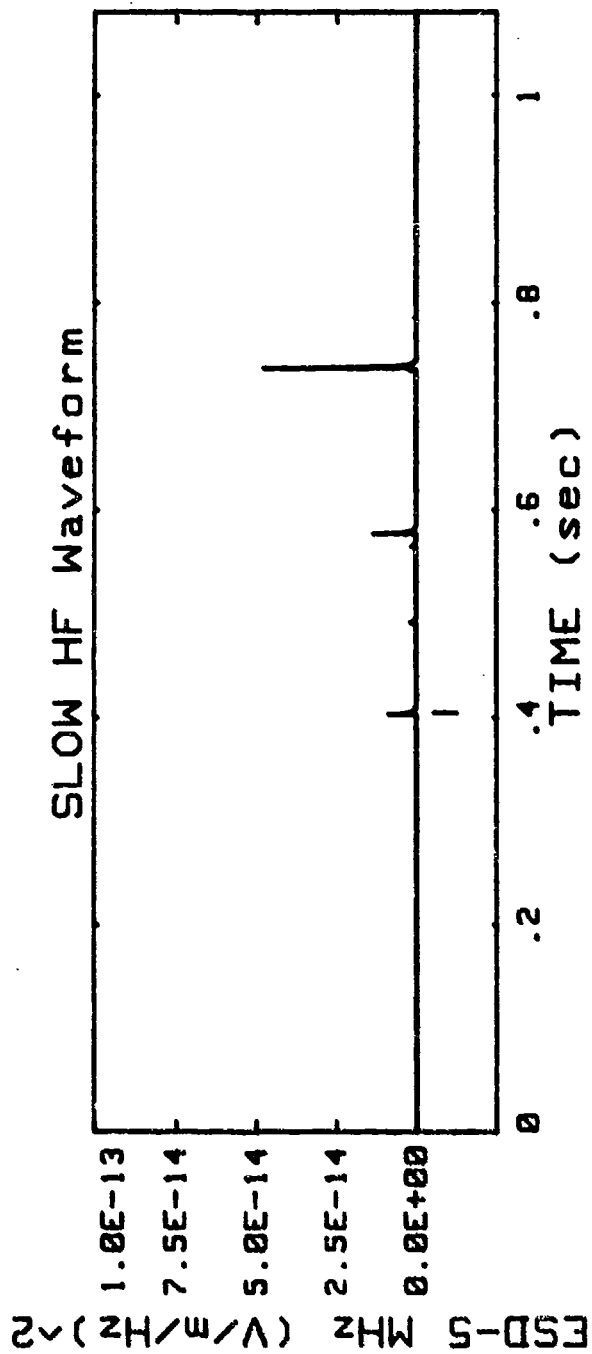
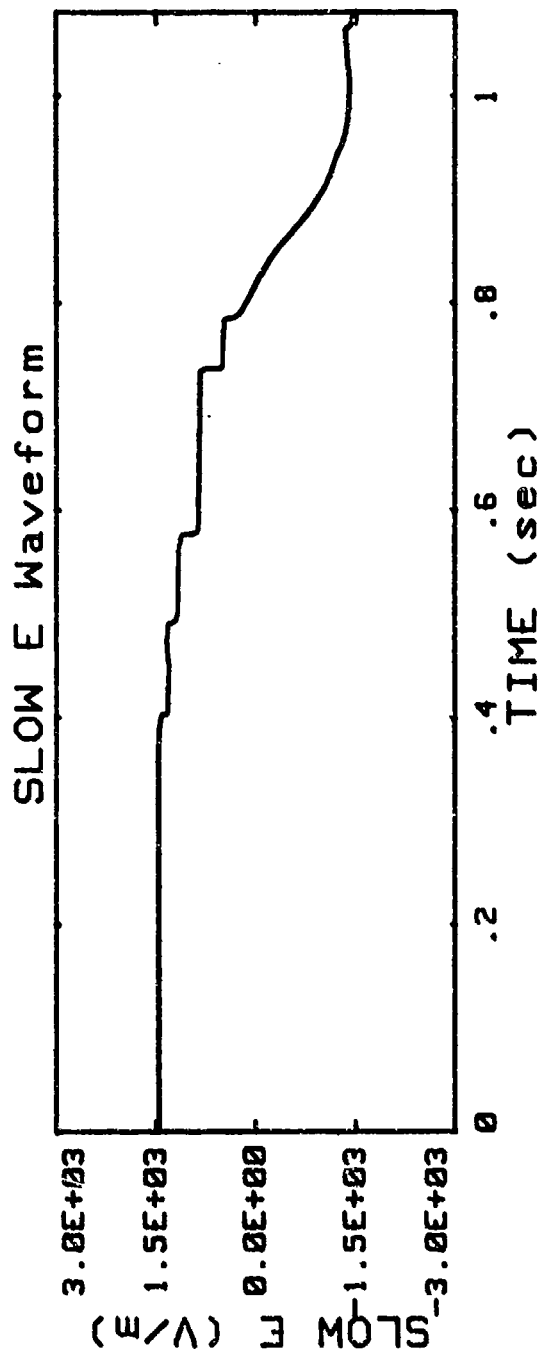


220194235.640 1985

Multiple Gnd RS (12.7 Km)

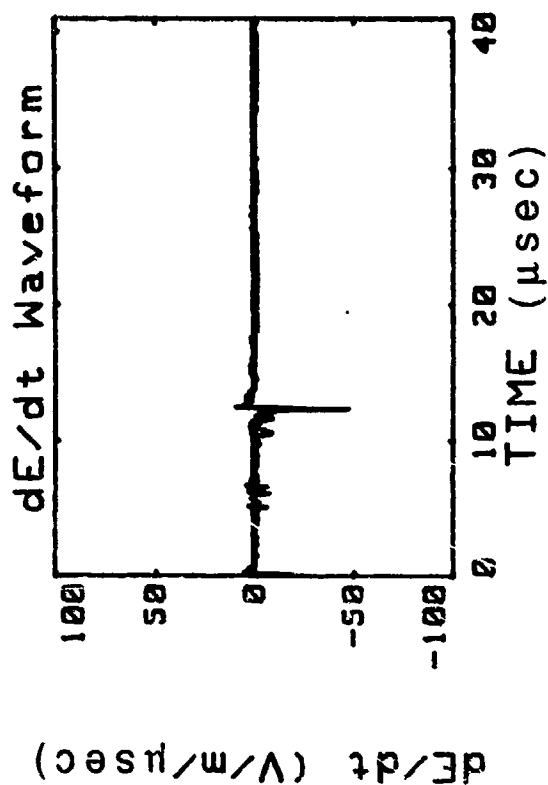
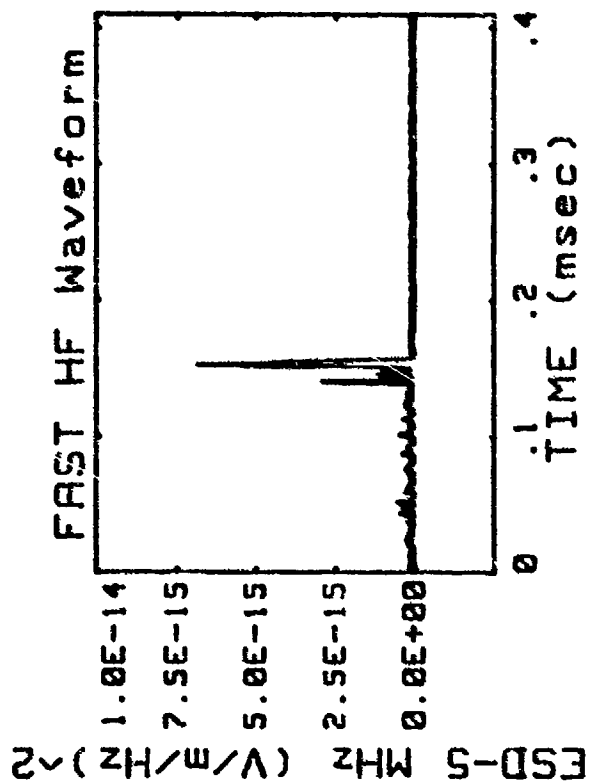
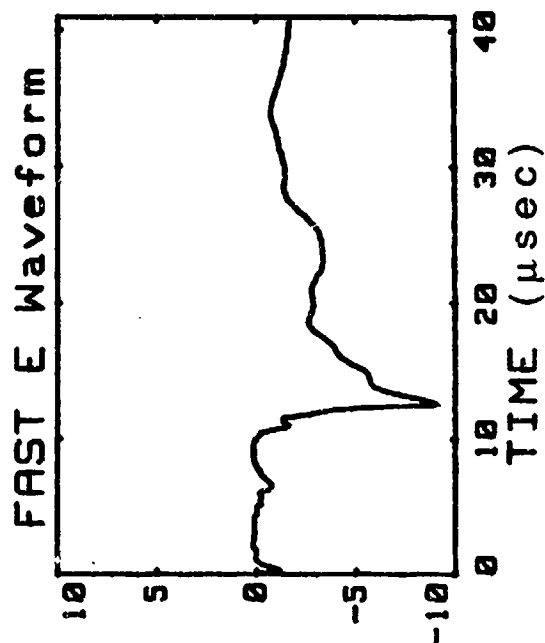
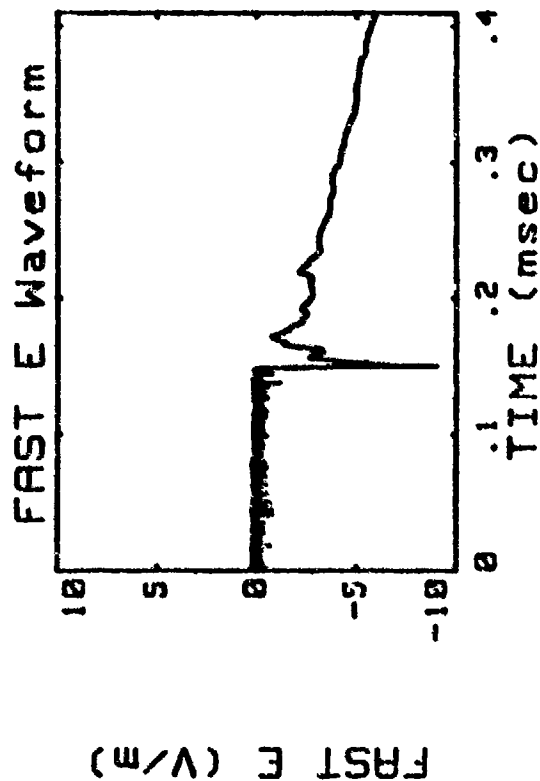


19:42:35.248 8 Aug 1985 (12.7 Km)

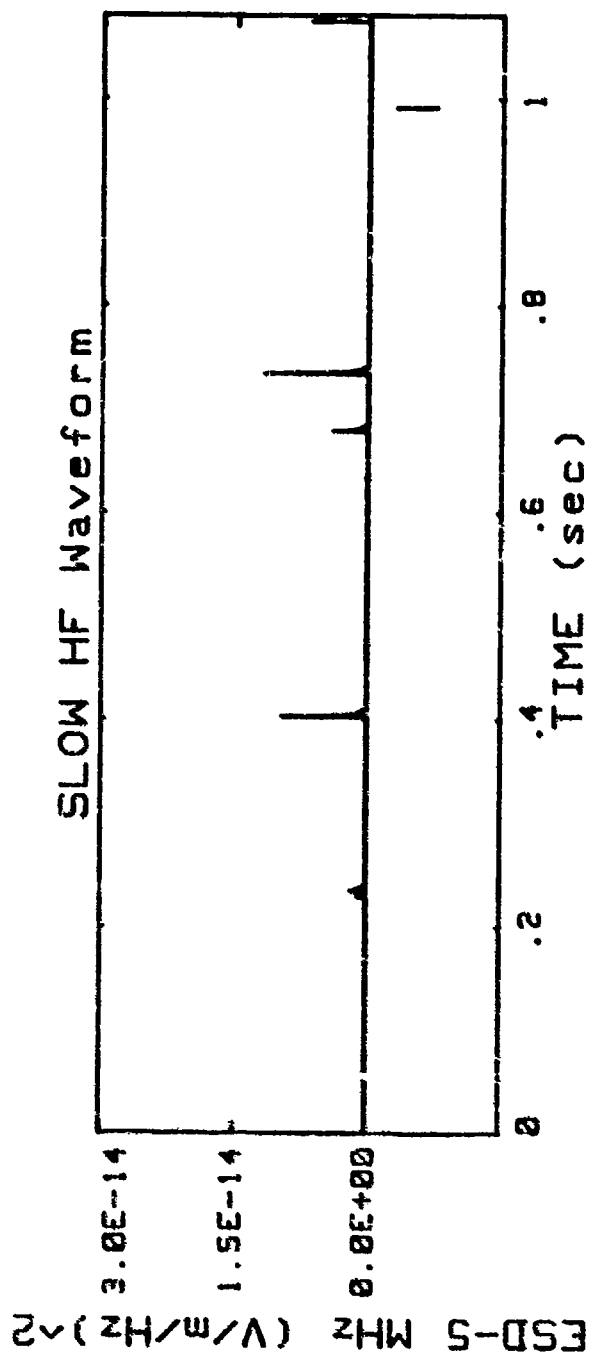
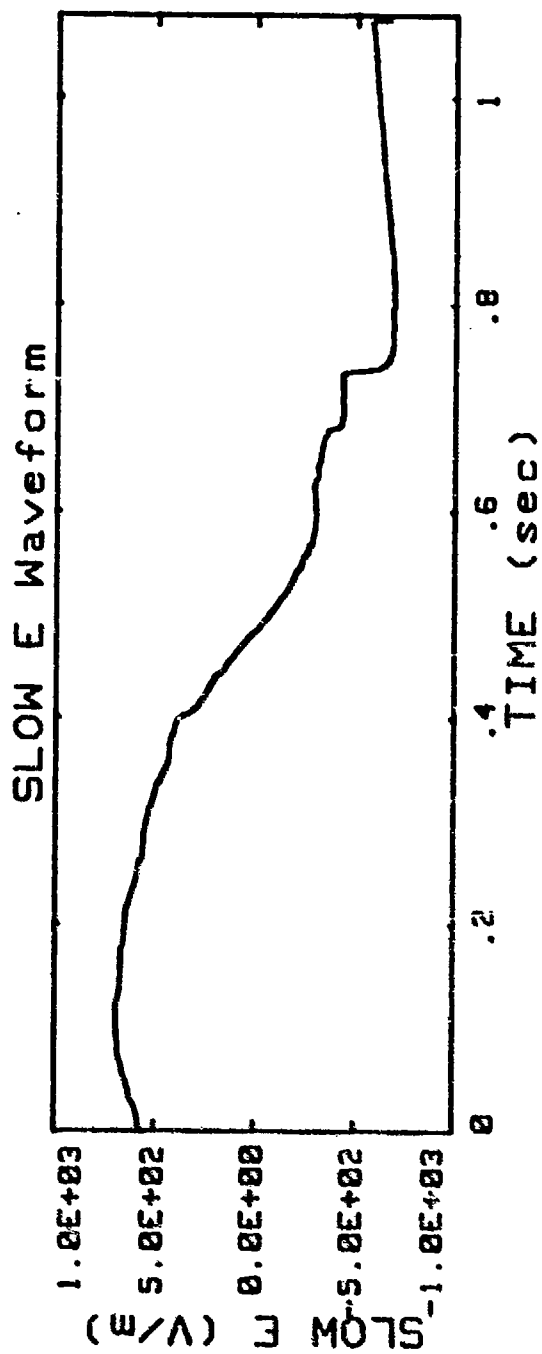


220194711.430 1985

DS Subs RS (14.3 Km)

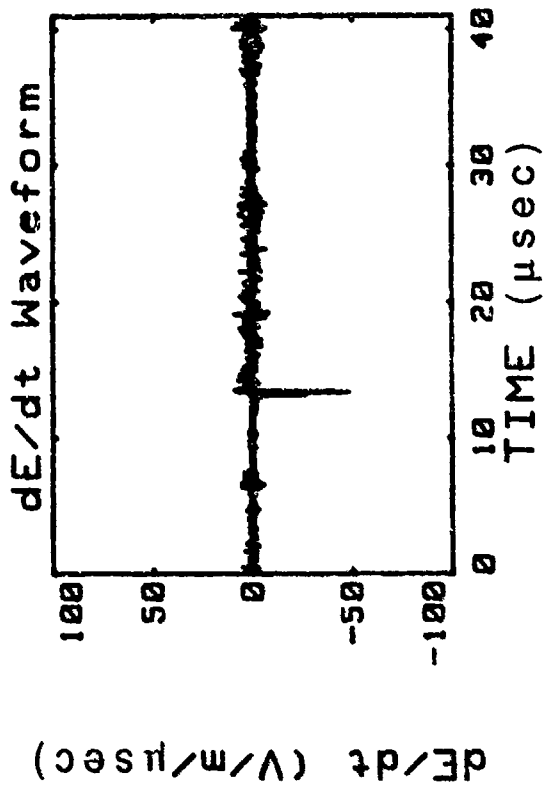
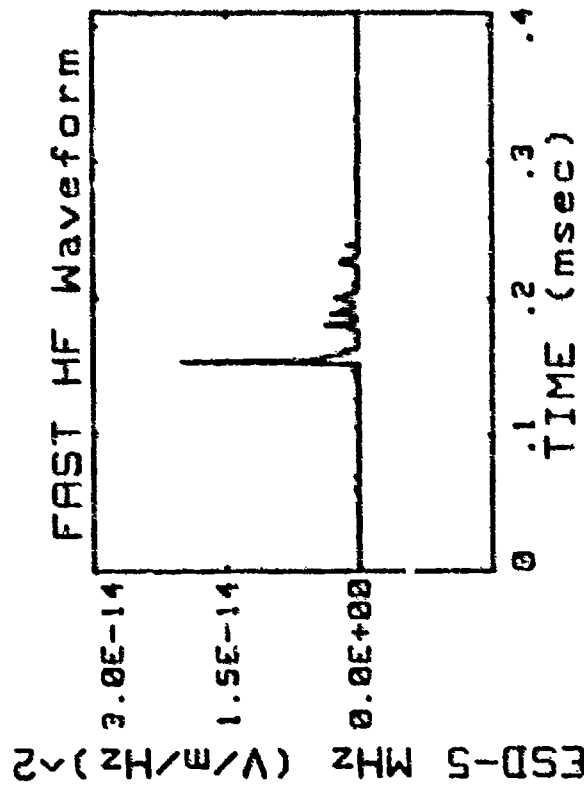
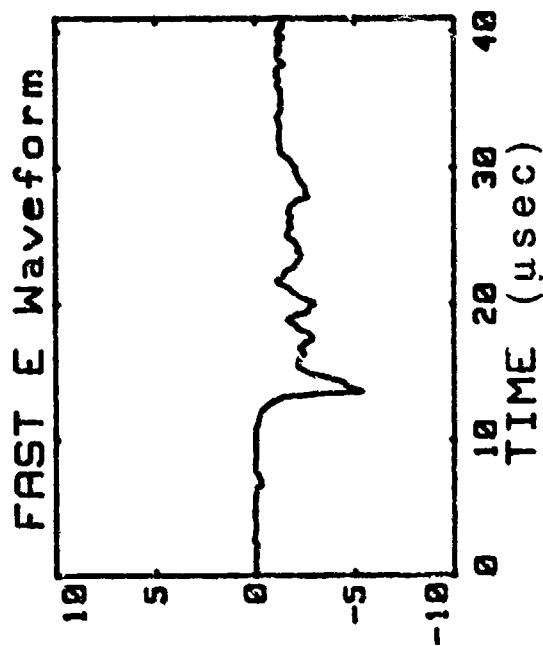
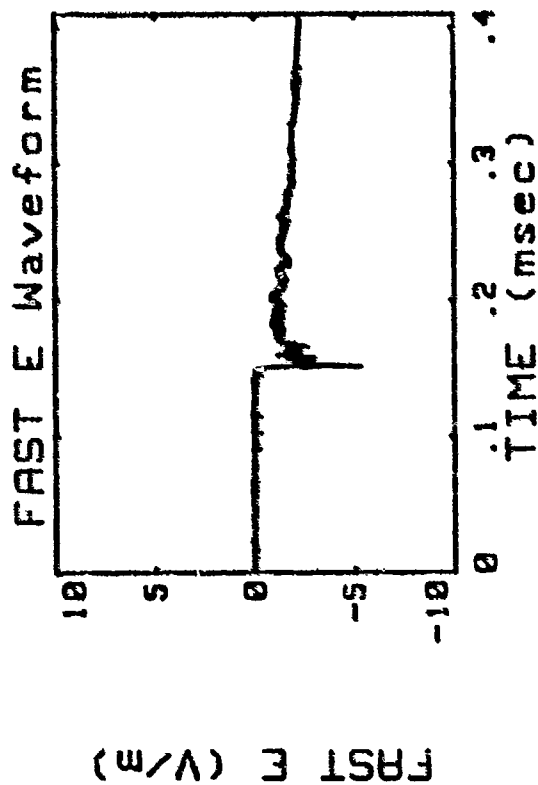


19:47:10.451 8 Aug 1985 (14.3 Km)

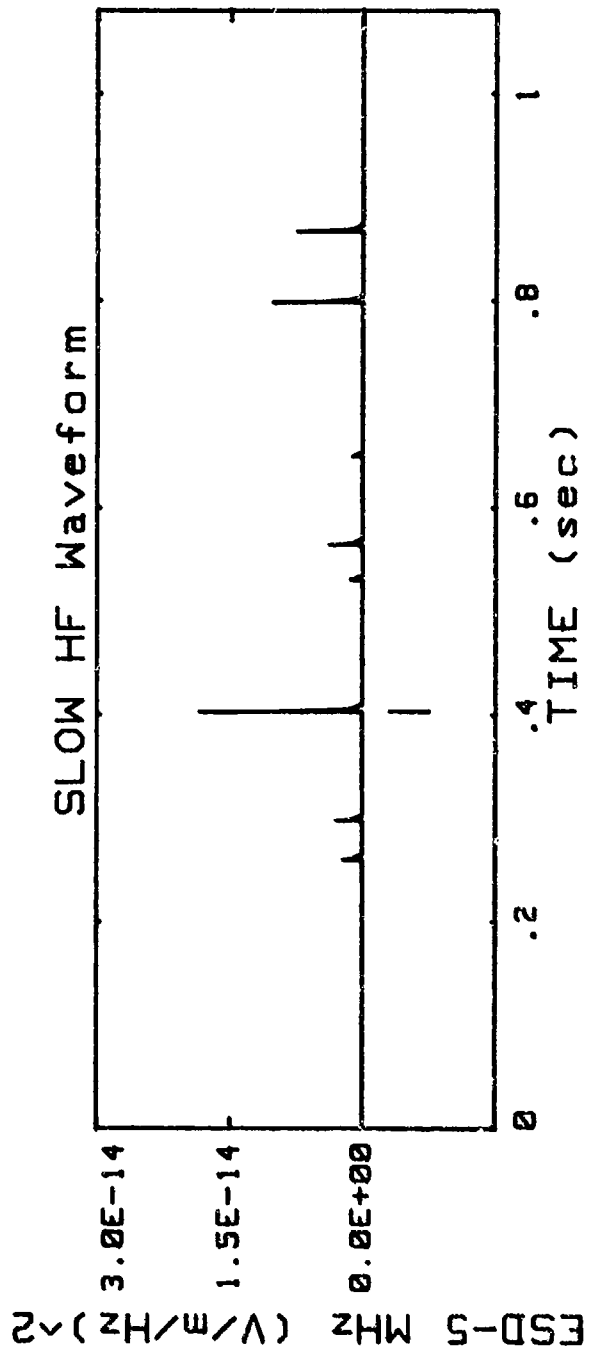
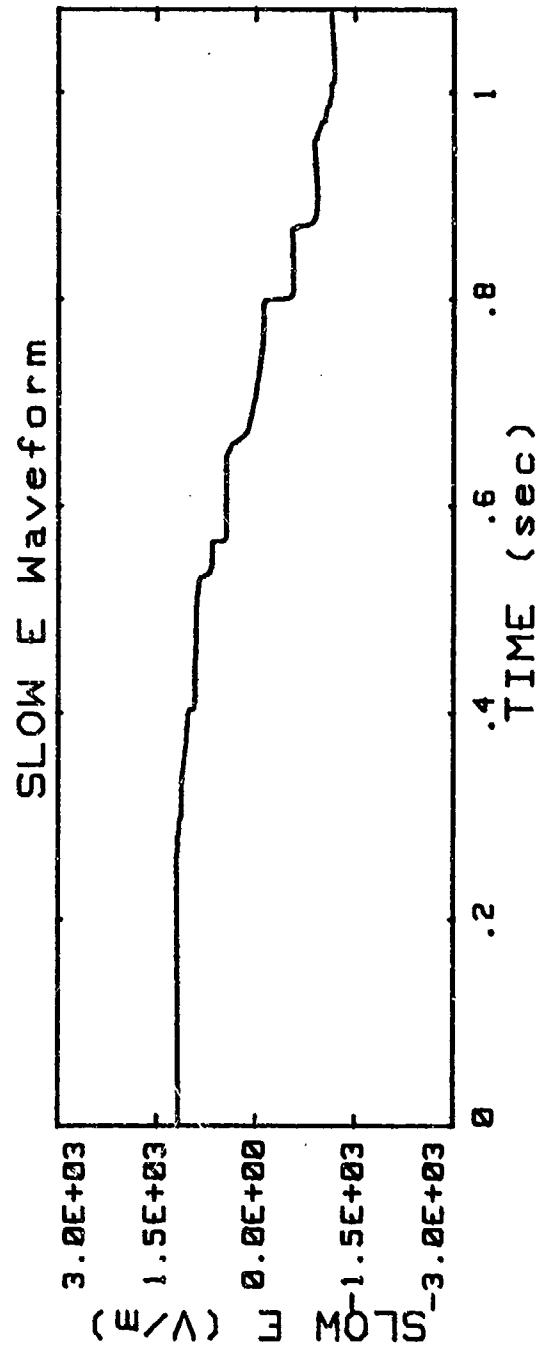


220194740.669 1985

1st RS (14 Km)

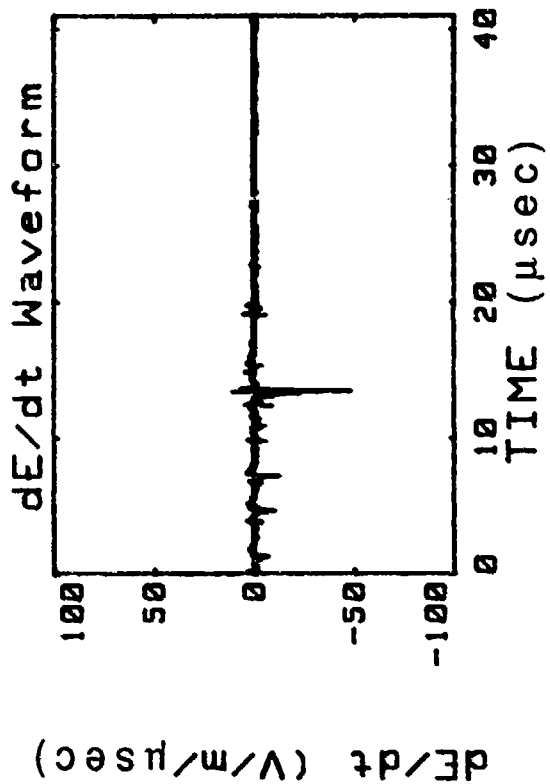
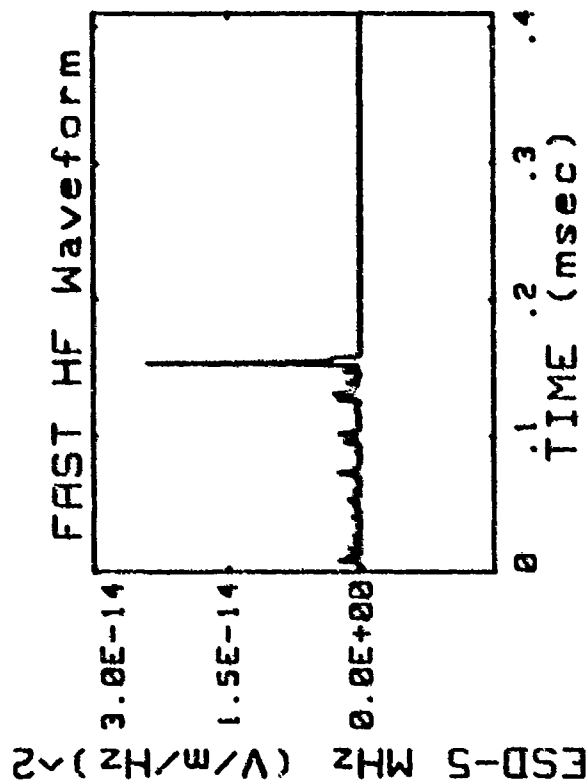
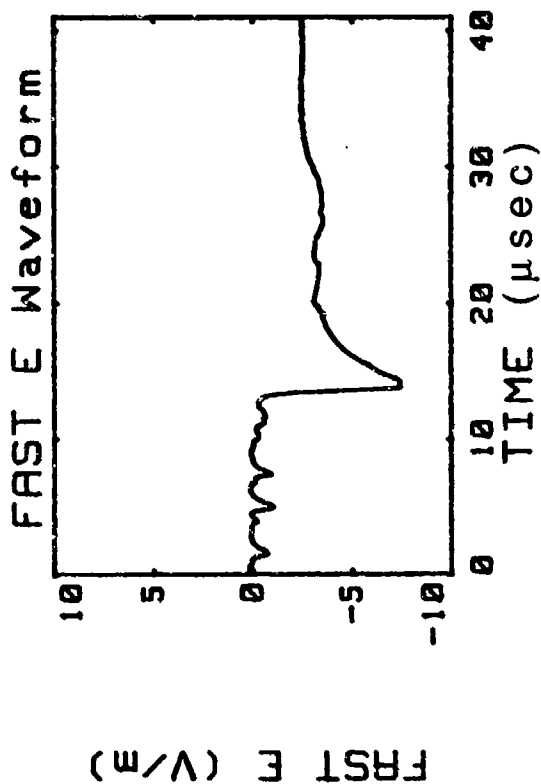
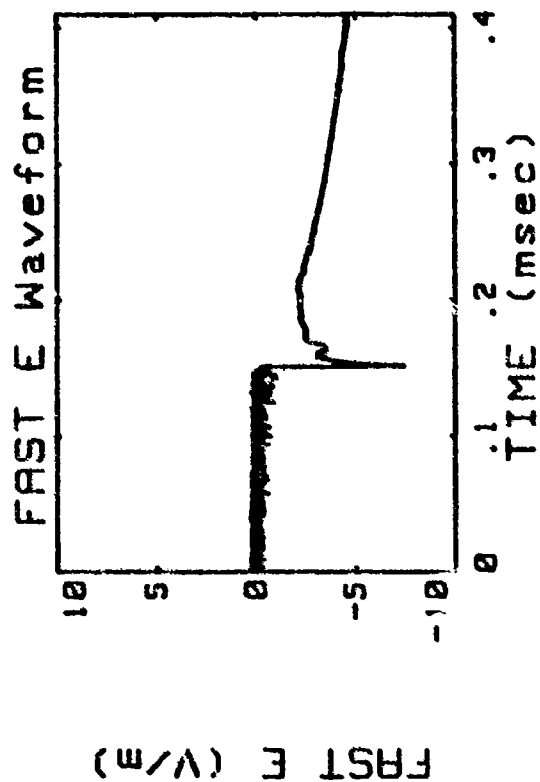


19:47:40.278 8 Aug 1985 (14 Km)

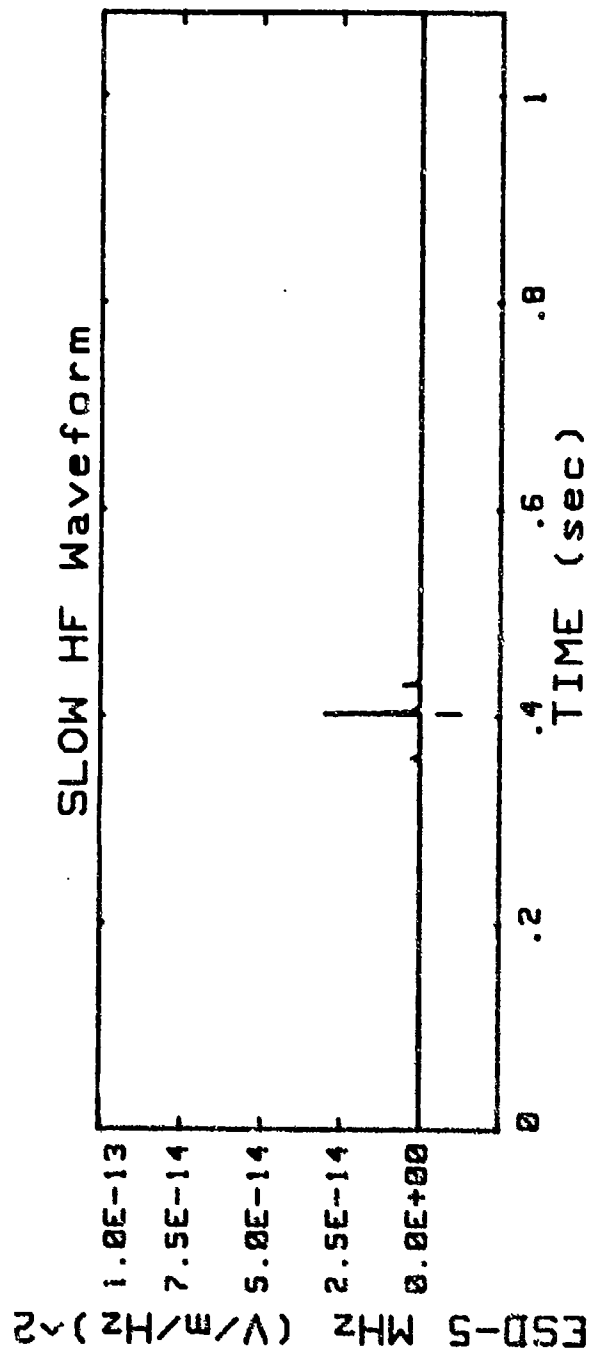
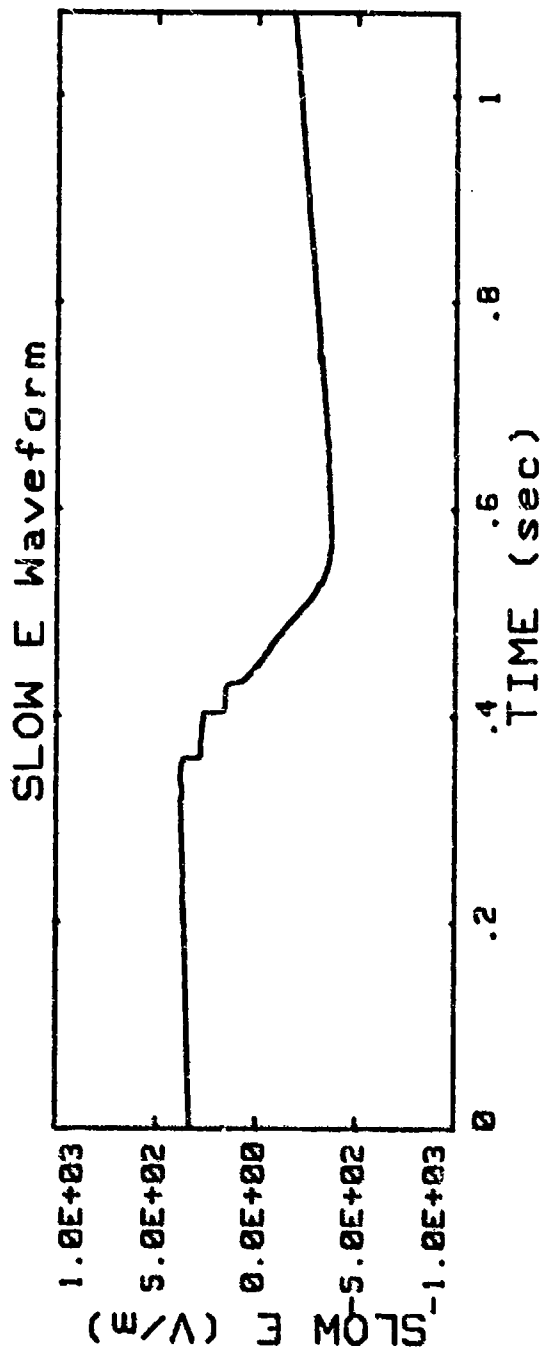


220195104.084 1985

DS Subs RS (12.5 Km)

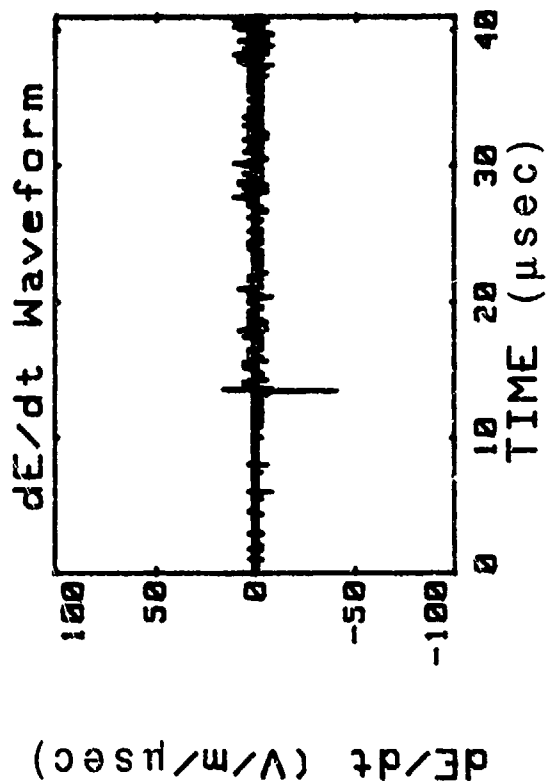
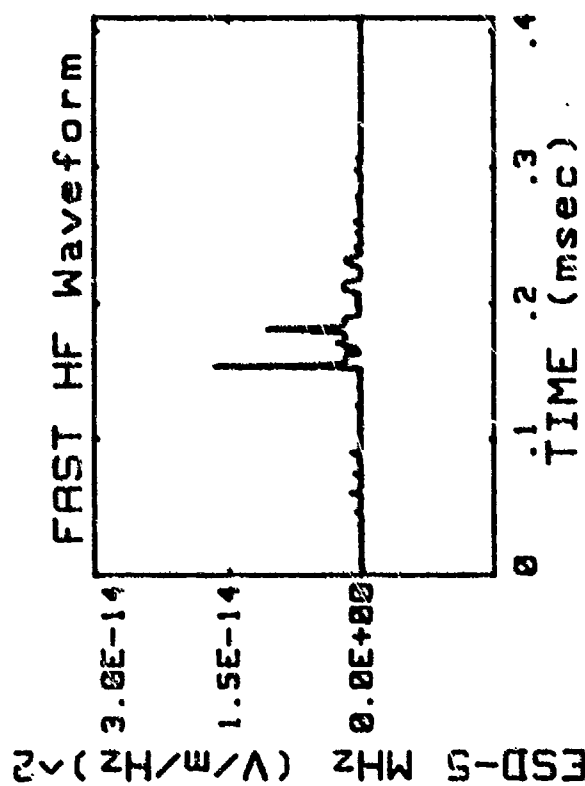
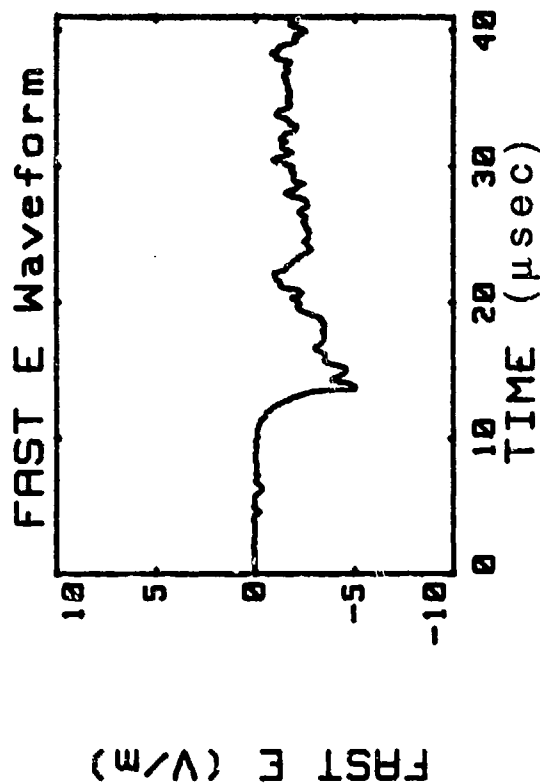
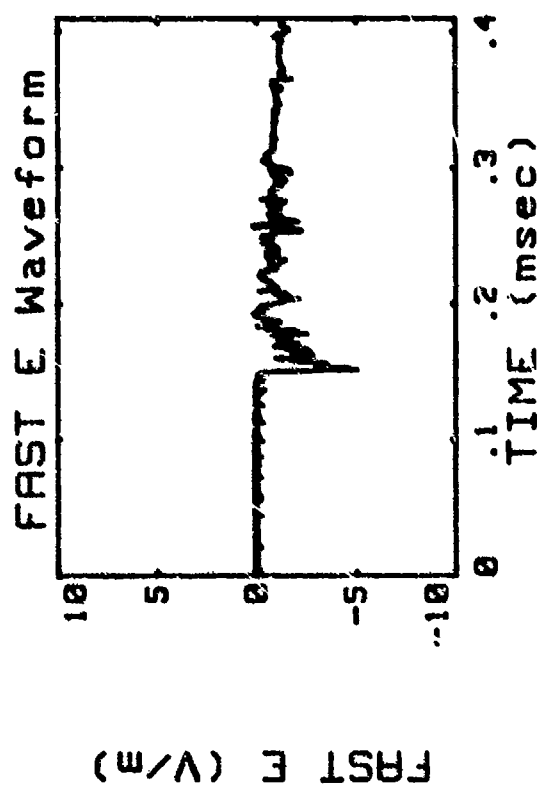


19:51:03.694 8 Aug 1985 (12.5 Km)



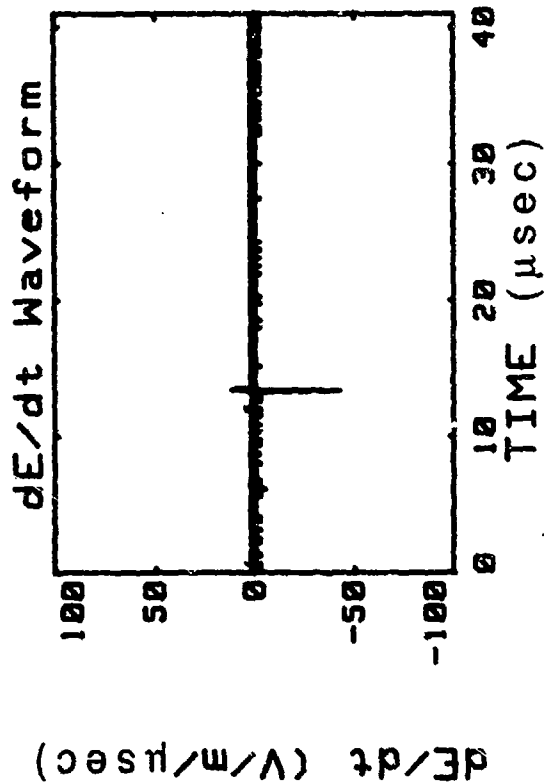
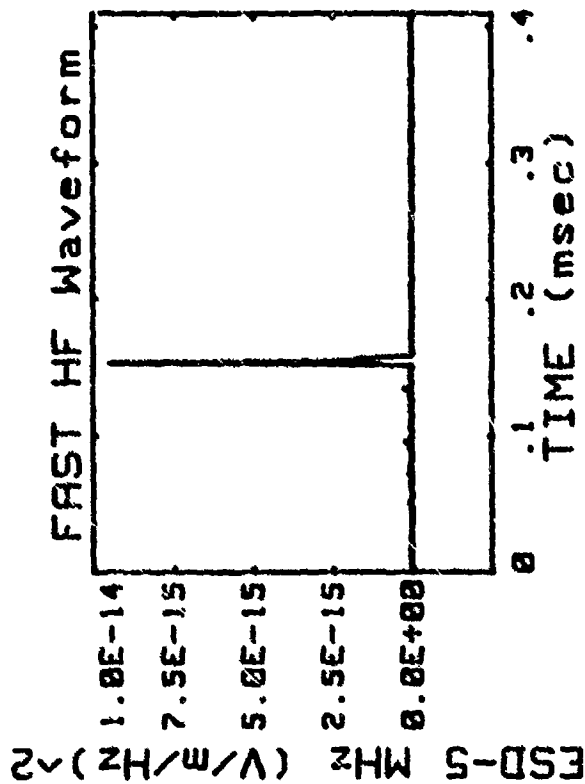
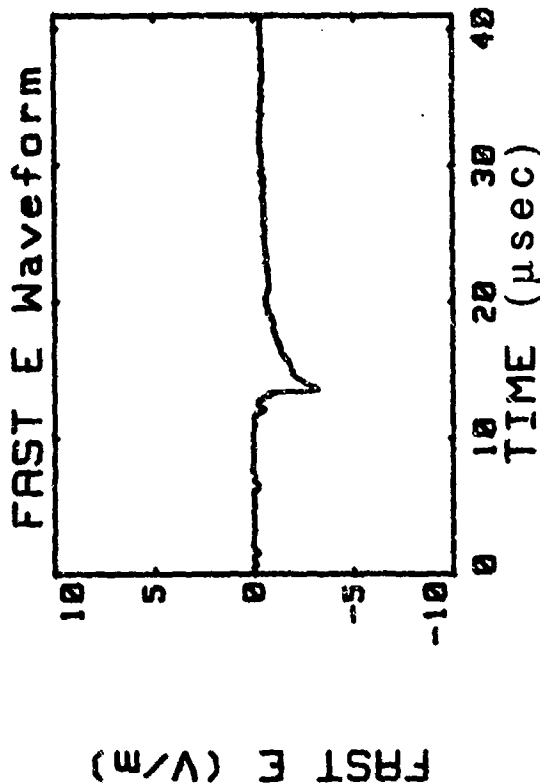
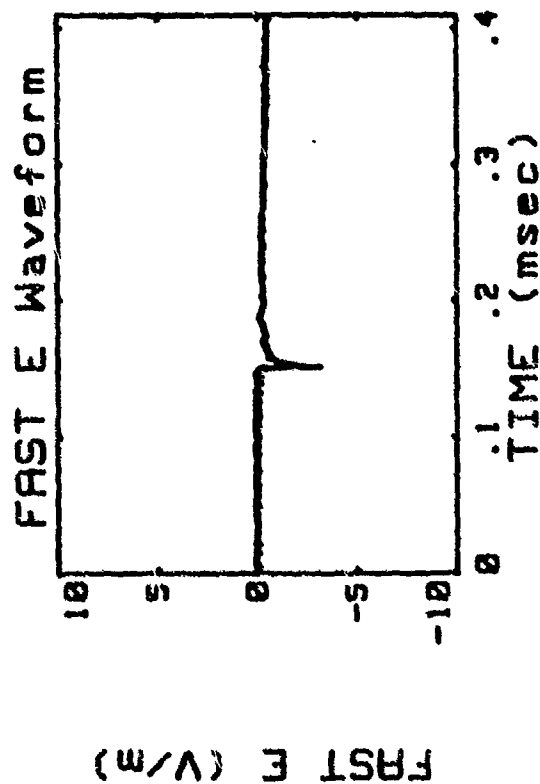
220200412.243 1985

1st RS (28.7 Km)



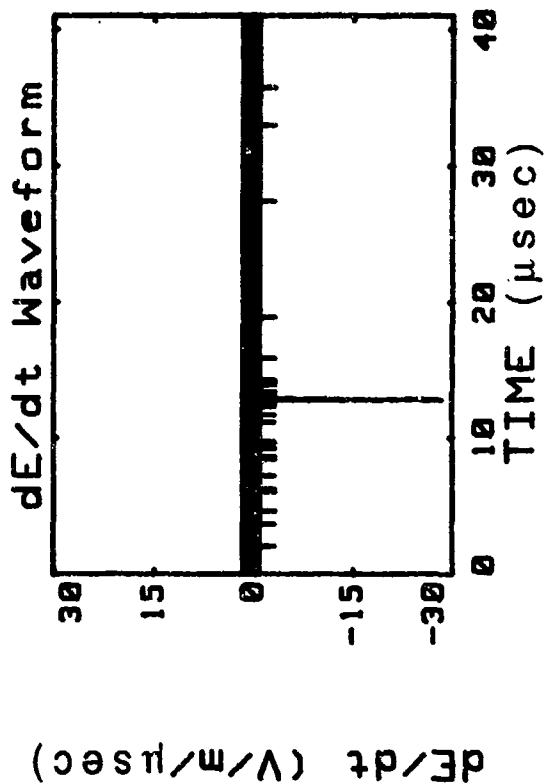
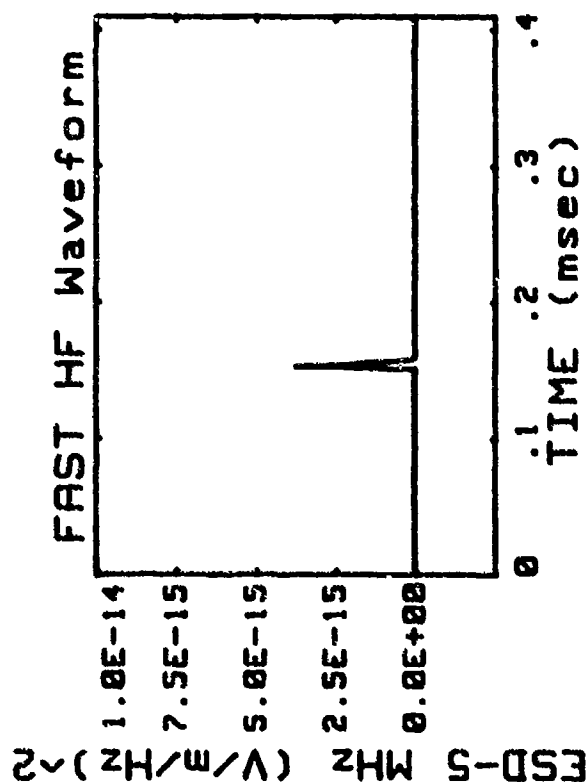
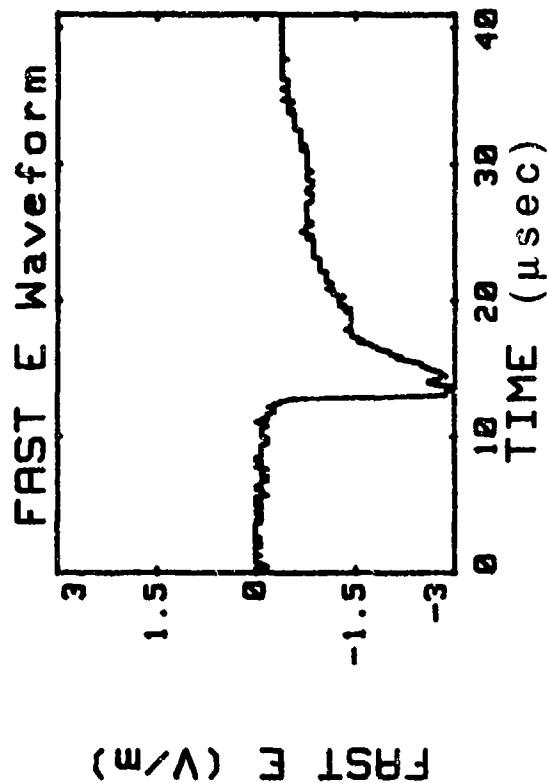
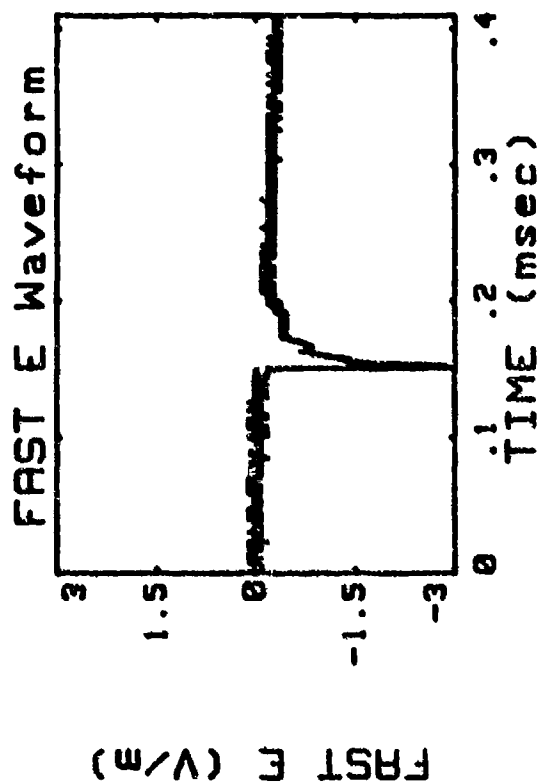
220200412.381 1985

DS Subs RS (28.7 Km)



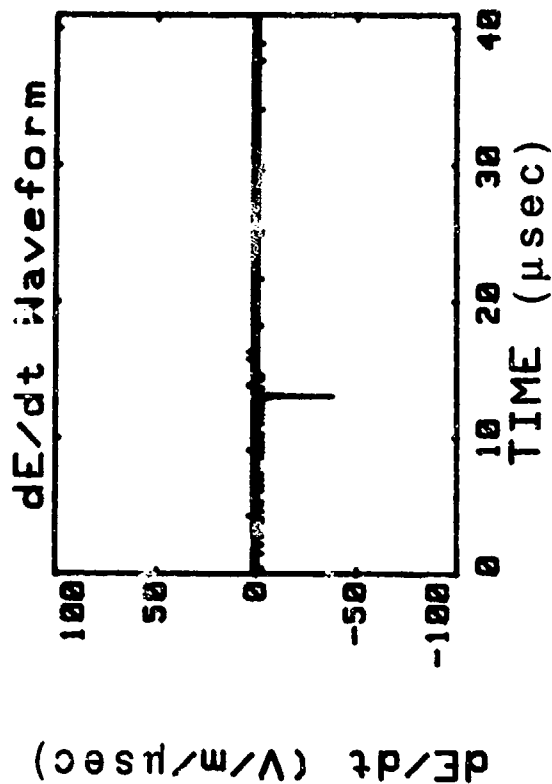
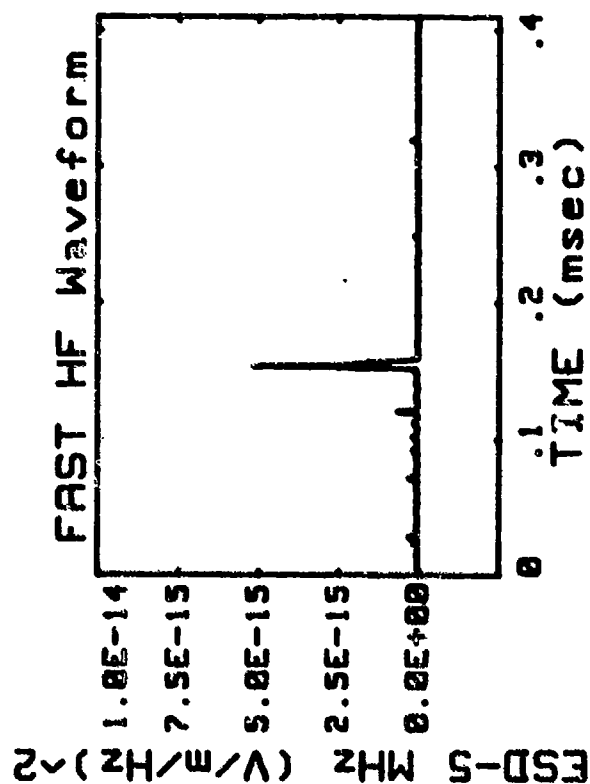
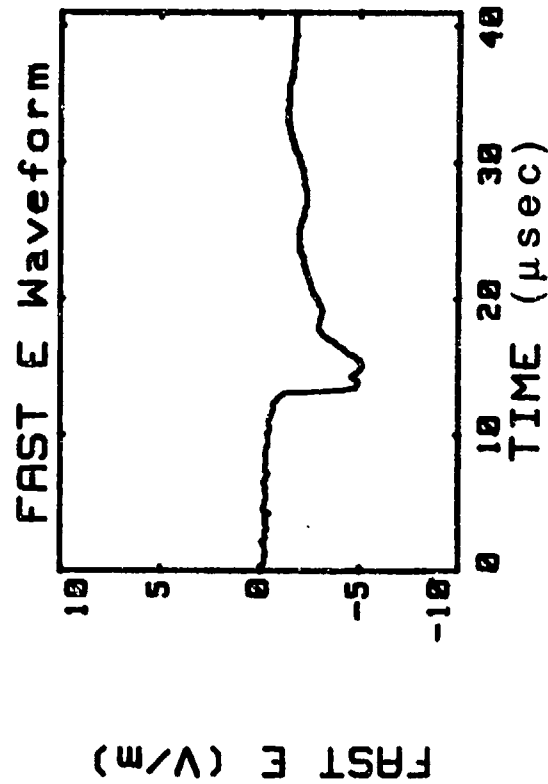
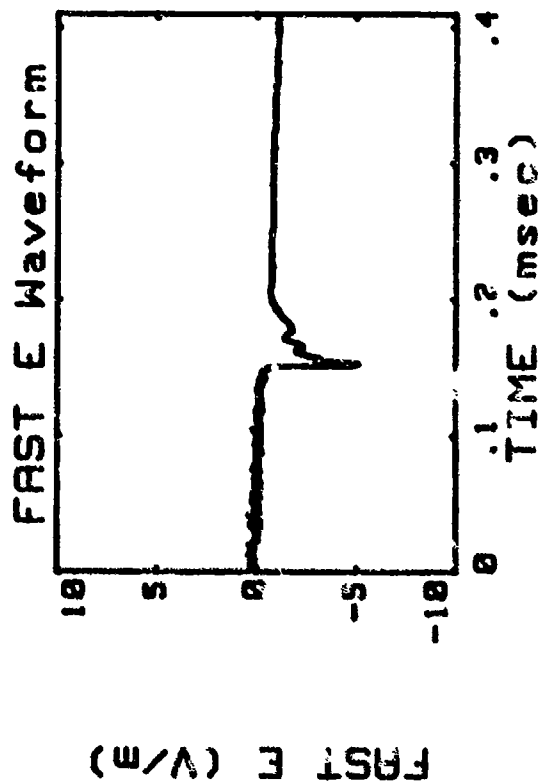
220200412.475 1985

Norm Subs RS (28.7 Km)



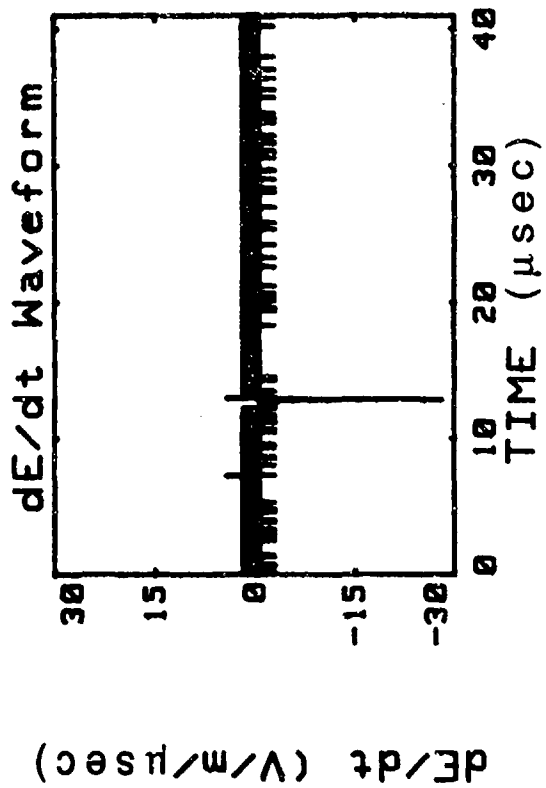
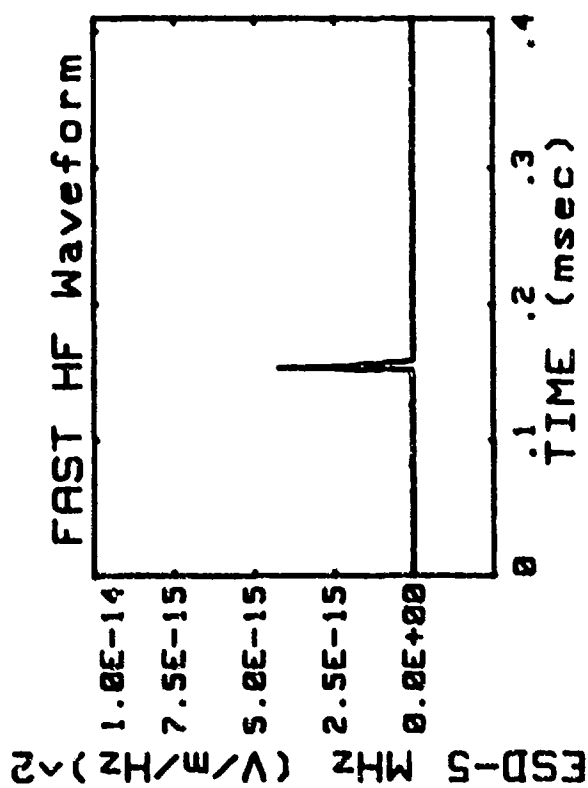
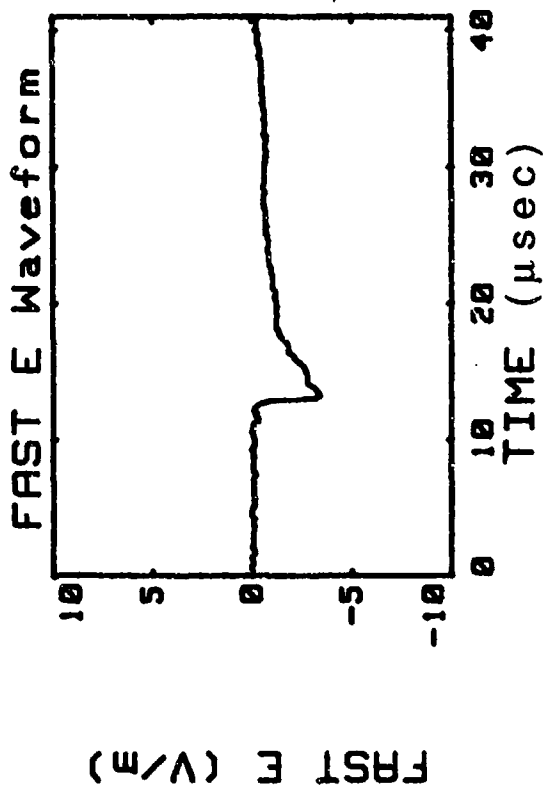
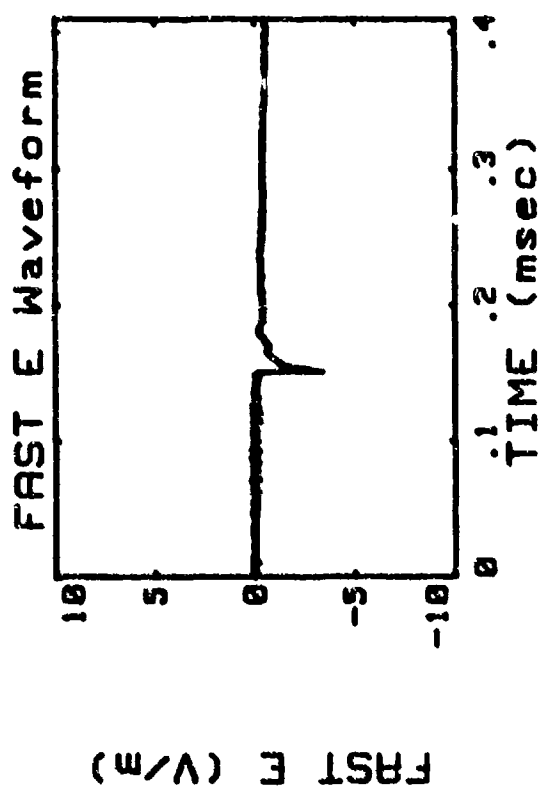
220200412.686 1985

Norm Subs RS (28.7 Km)

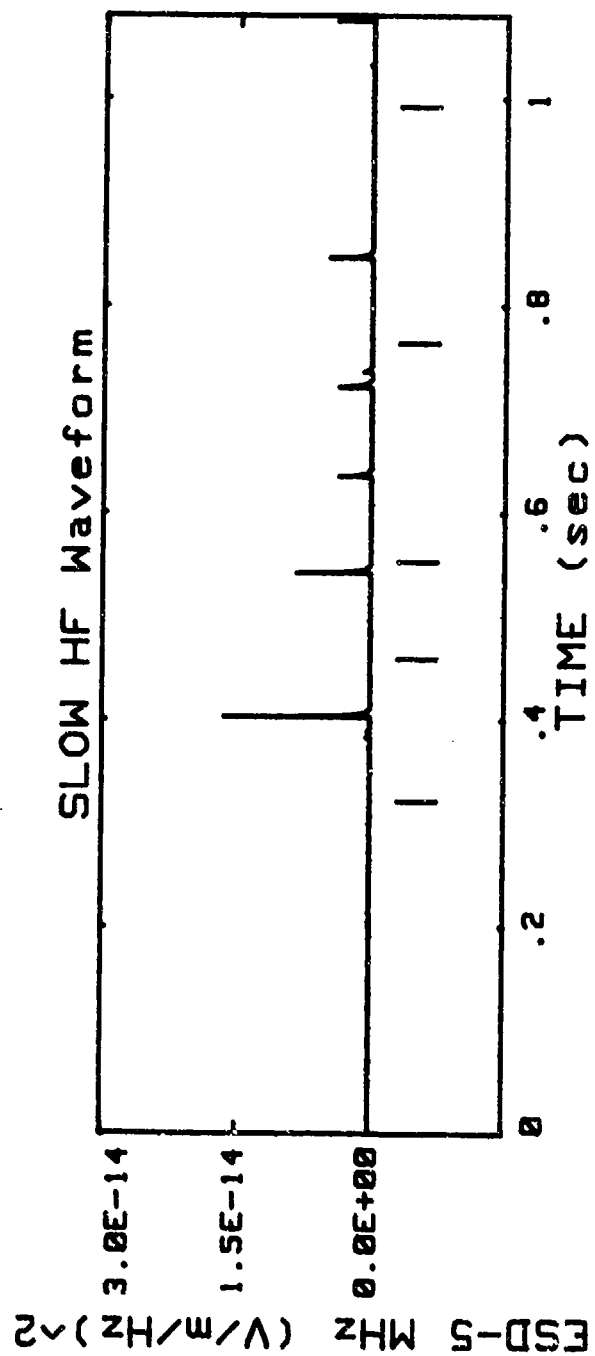
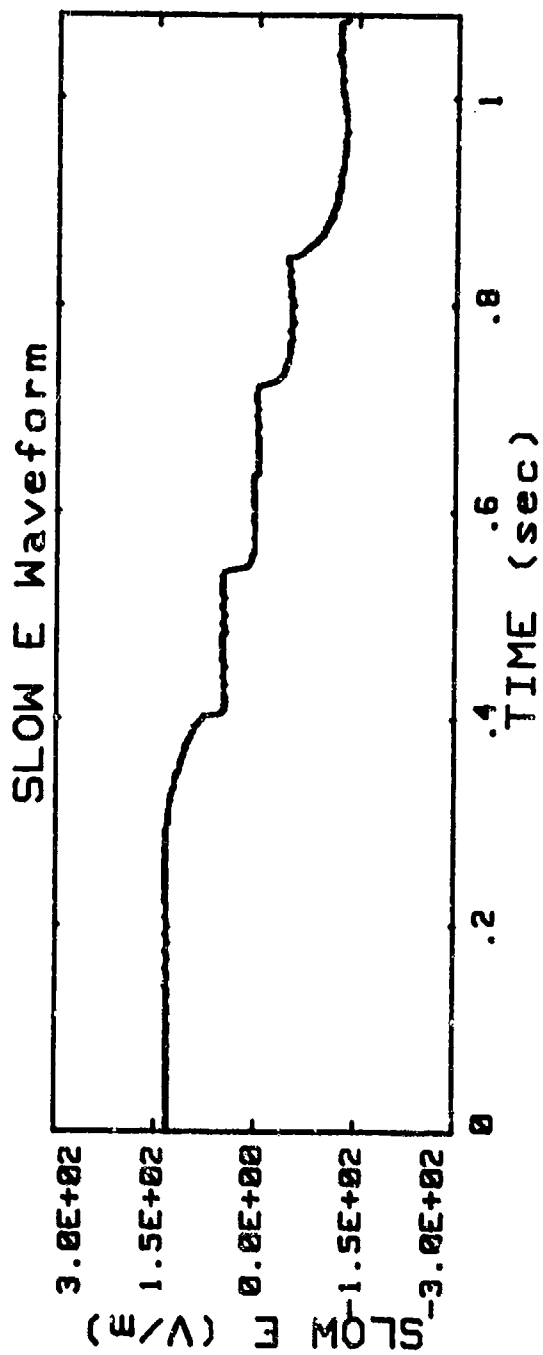


220200412.914 1985

Norm Subs RS (28.7 Km)

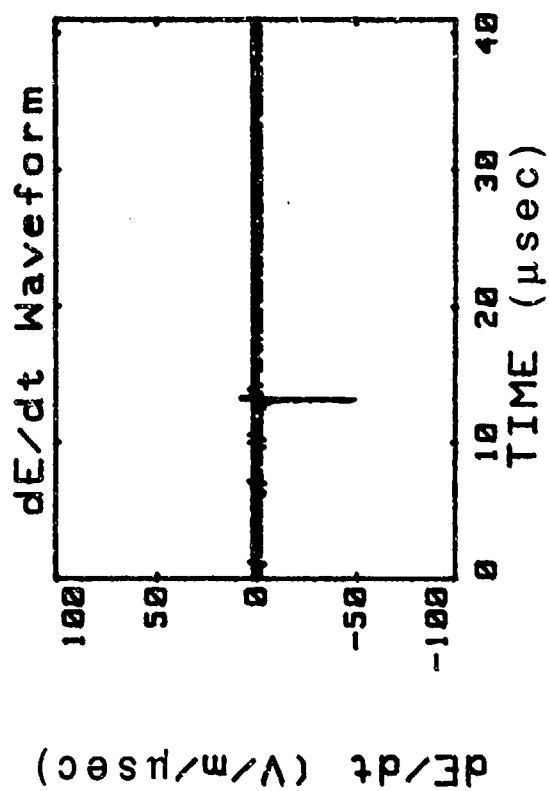
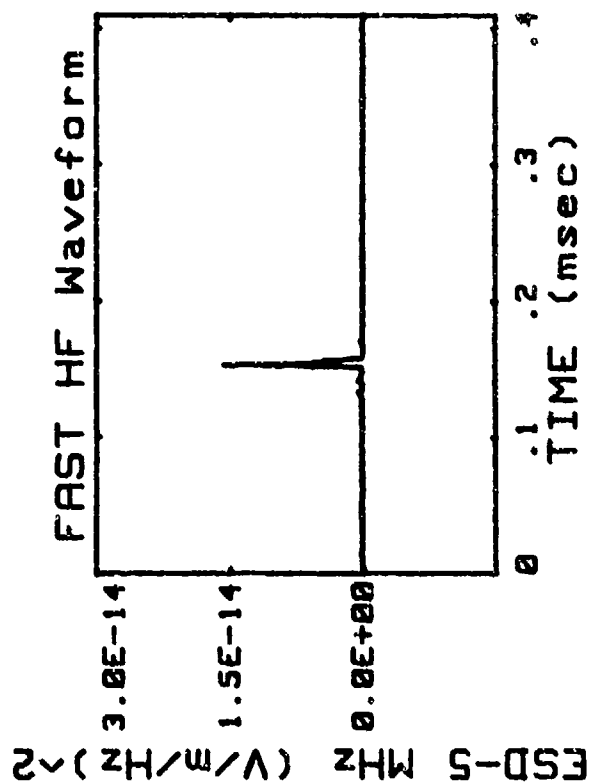
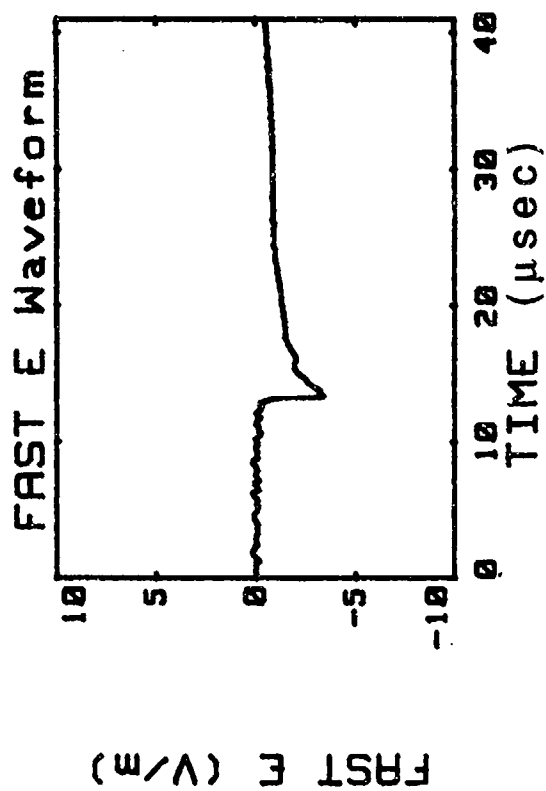
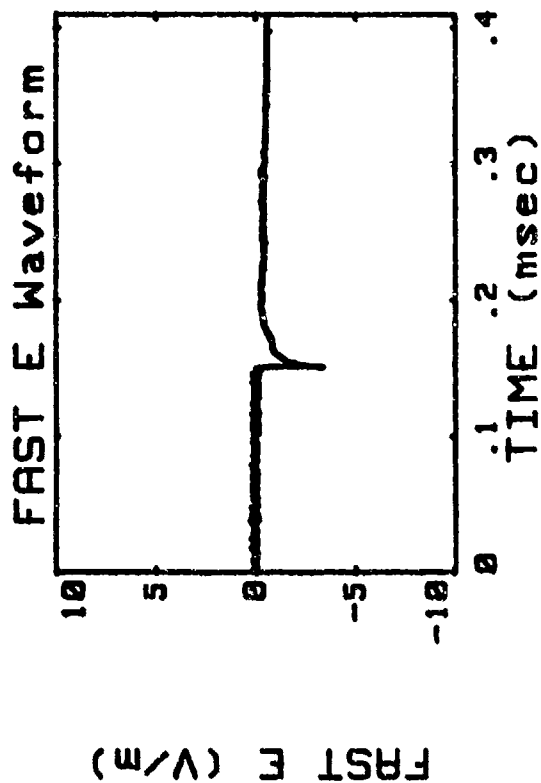


20:04:11.934 8 Aug 1985 (28.7 Km)

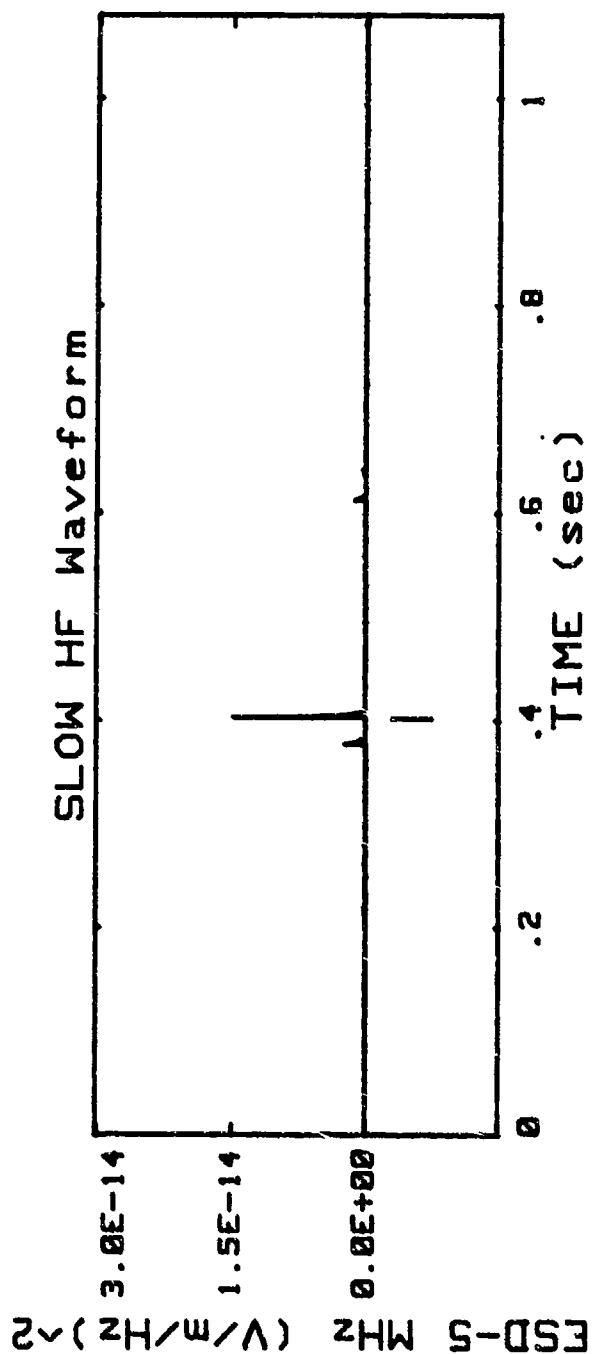
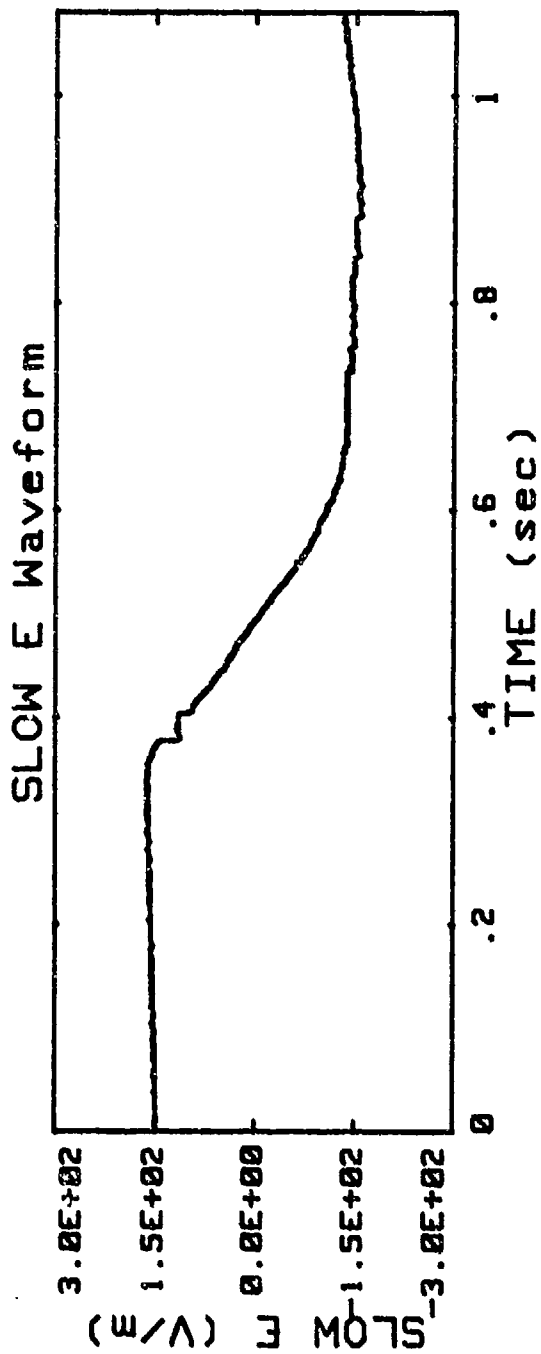


220200900.322 1985

Chaotic Subs R5 (23.6 Km)

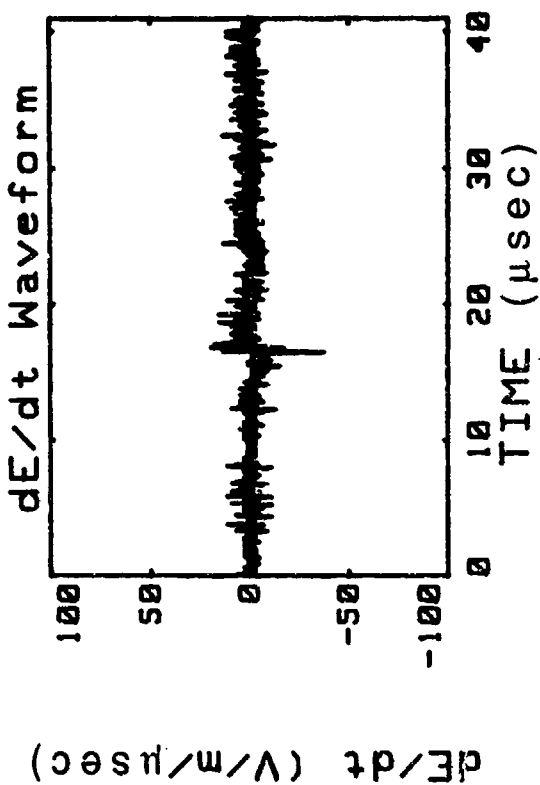
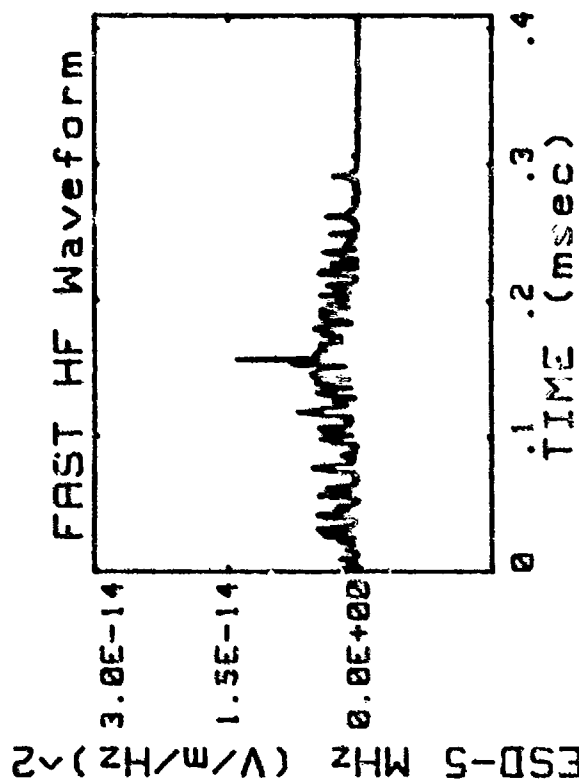
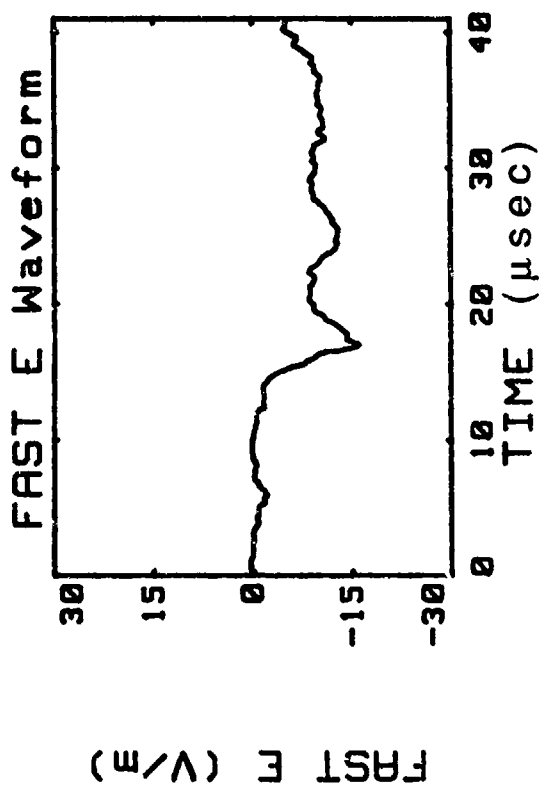
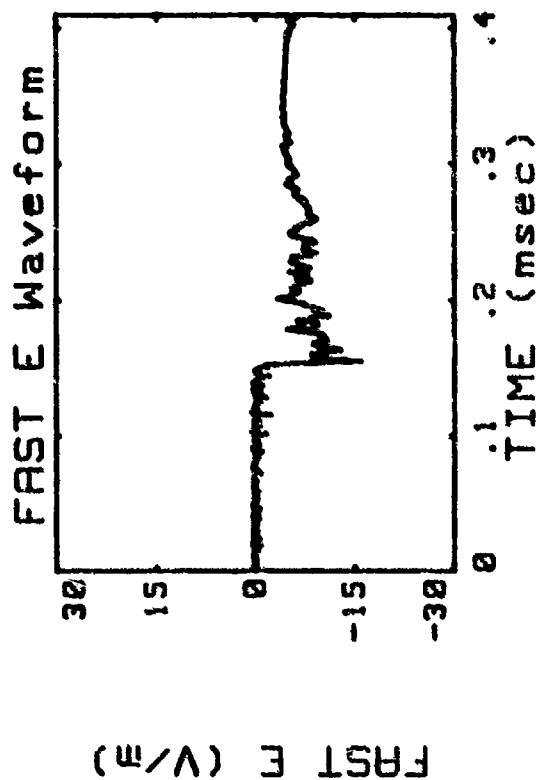


20:08:59.933 8 Aug 1985 (23.6 Km)

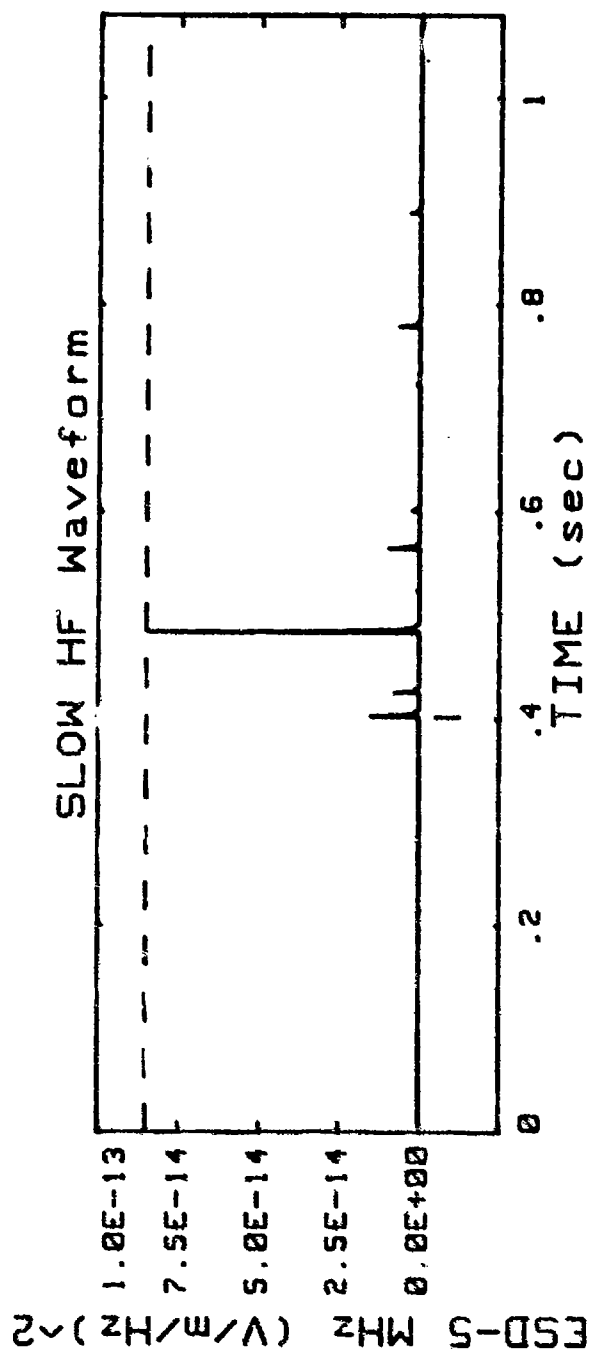
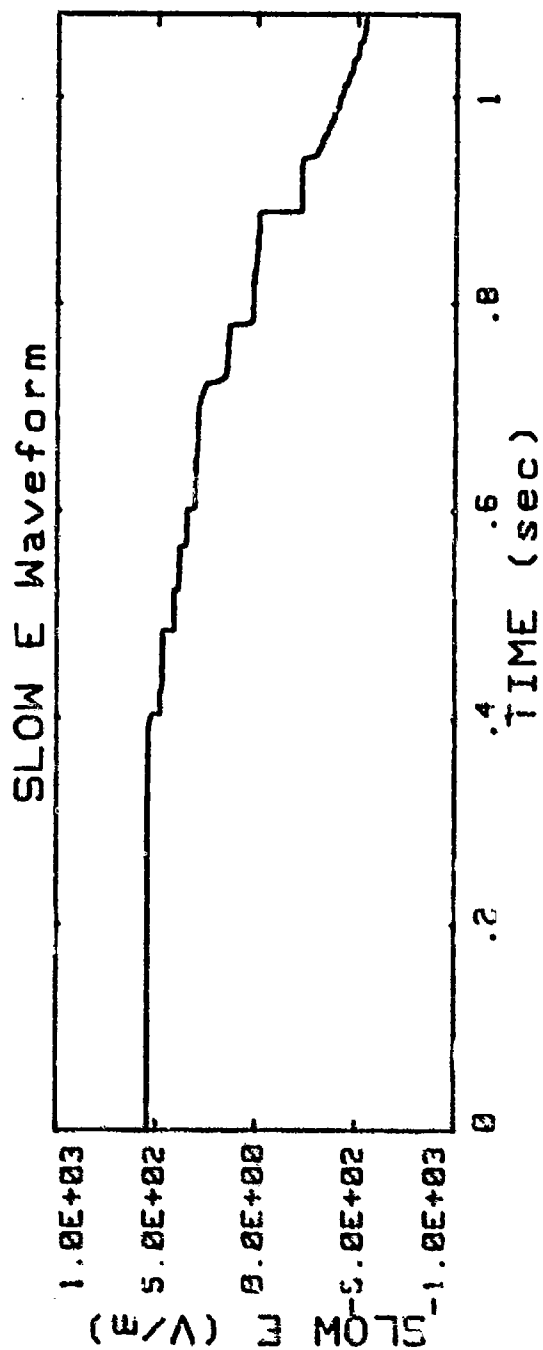


220200953.961 1985

1st RS (23.5 Km)

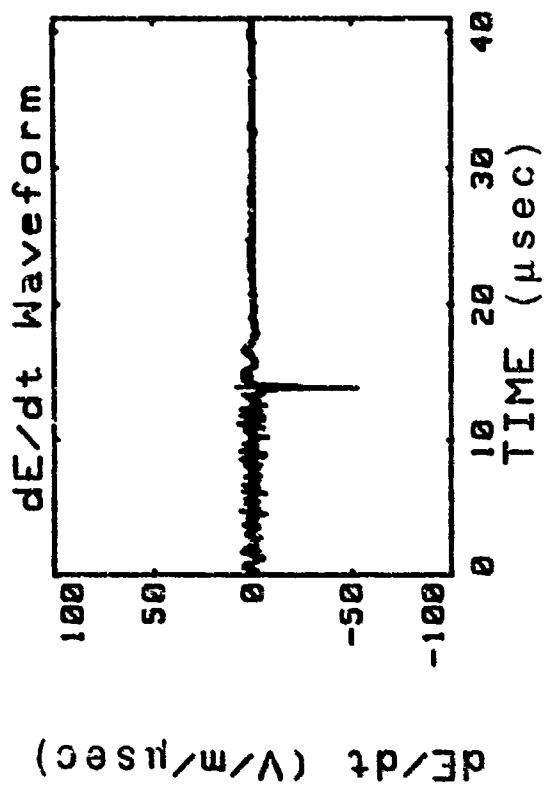
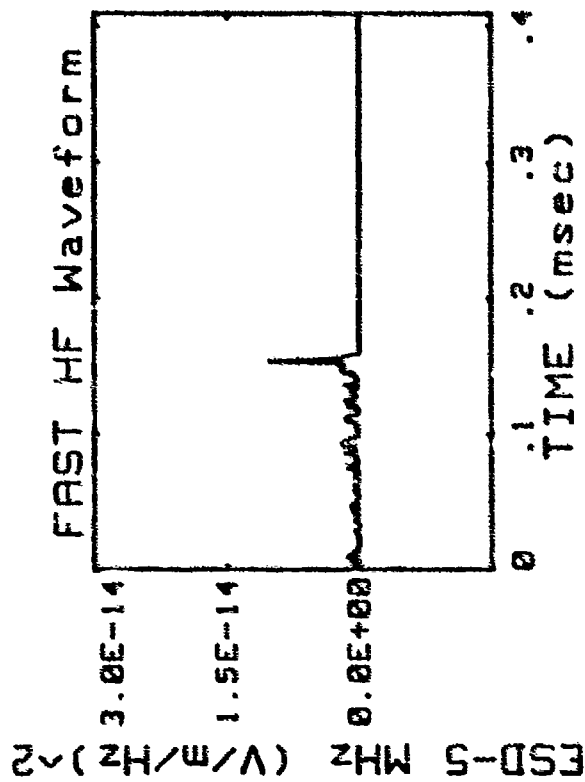
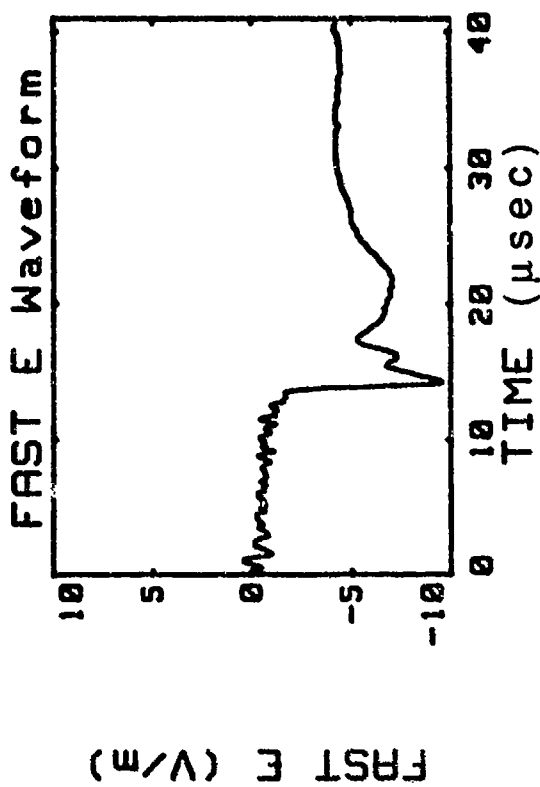
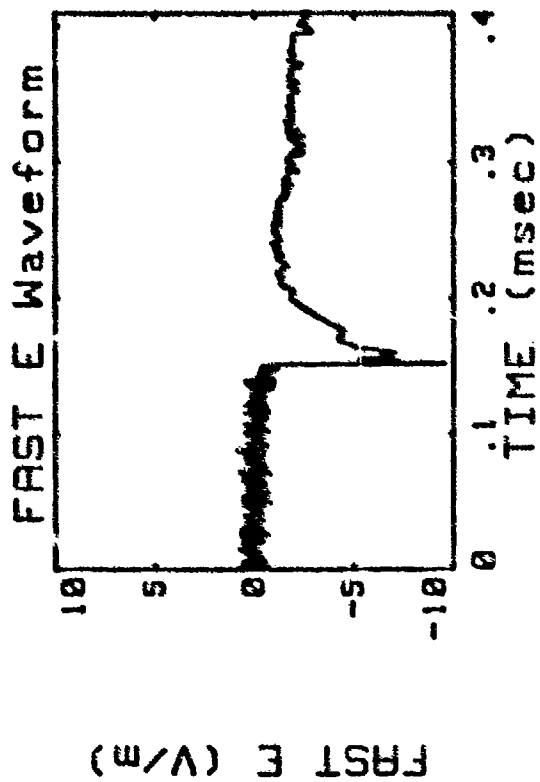


20:09:53.572 8 Aug 1985 (23.5 Km)

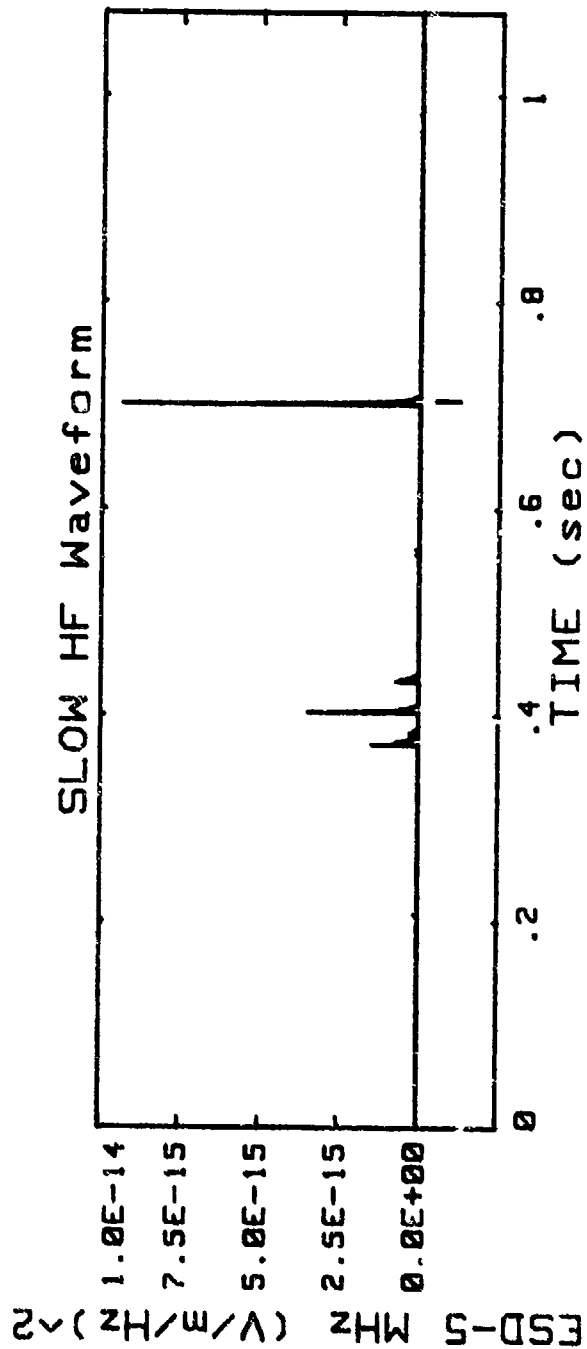
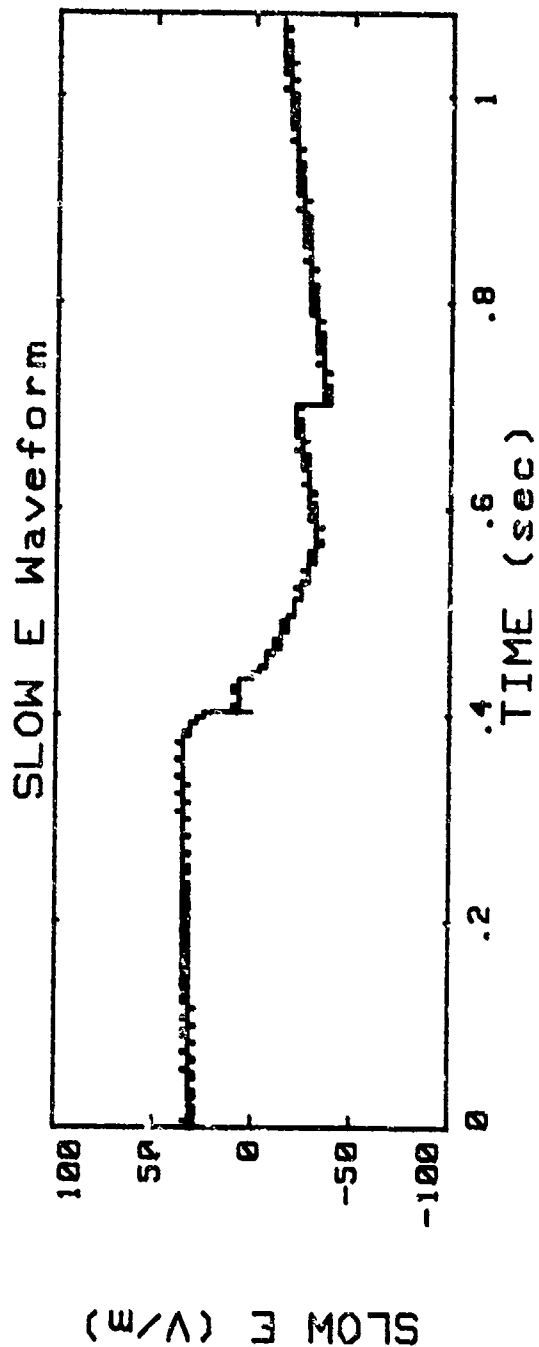


220201551.454 1985

Chaotic Subs RS (28.7 Km)

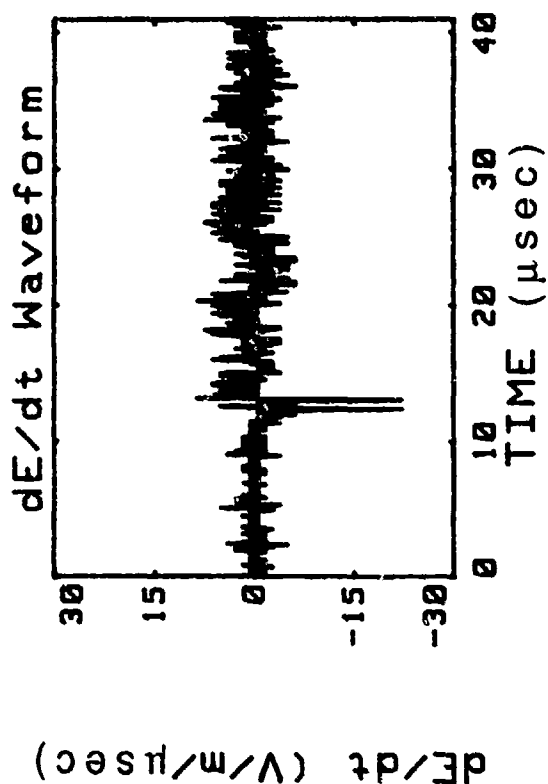
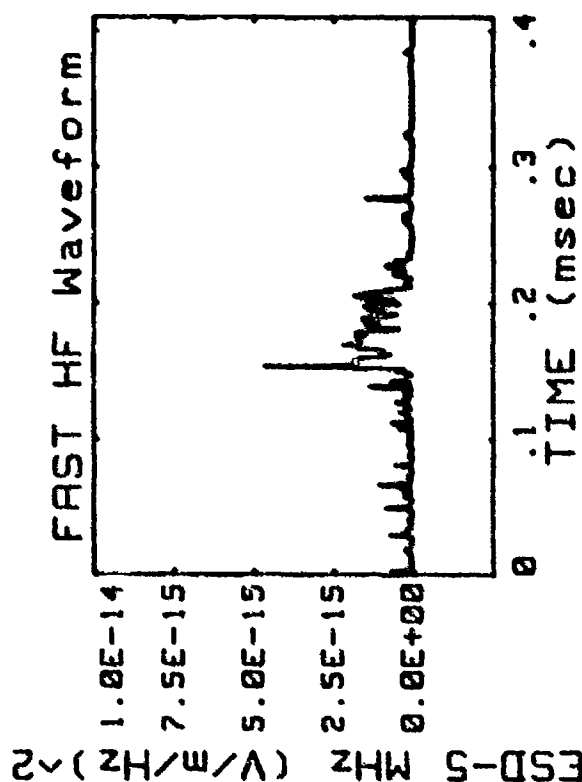
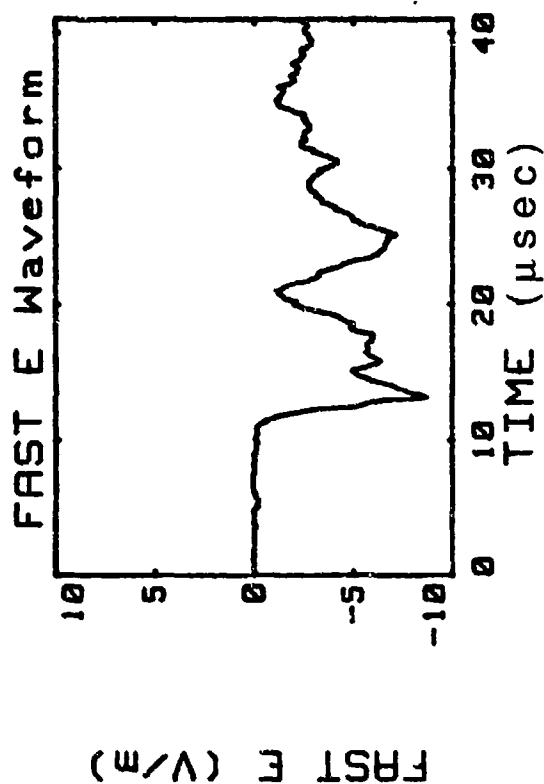
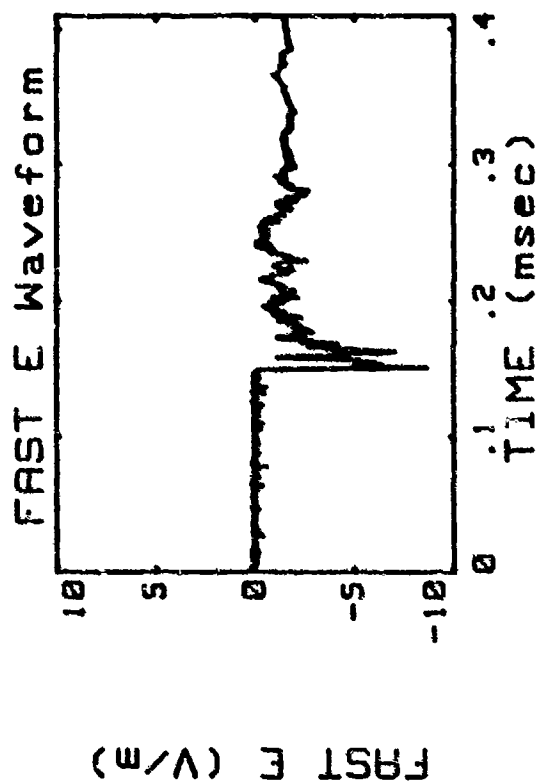


20:15:50.762 8 Aug 1985 (28.7 Km)

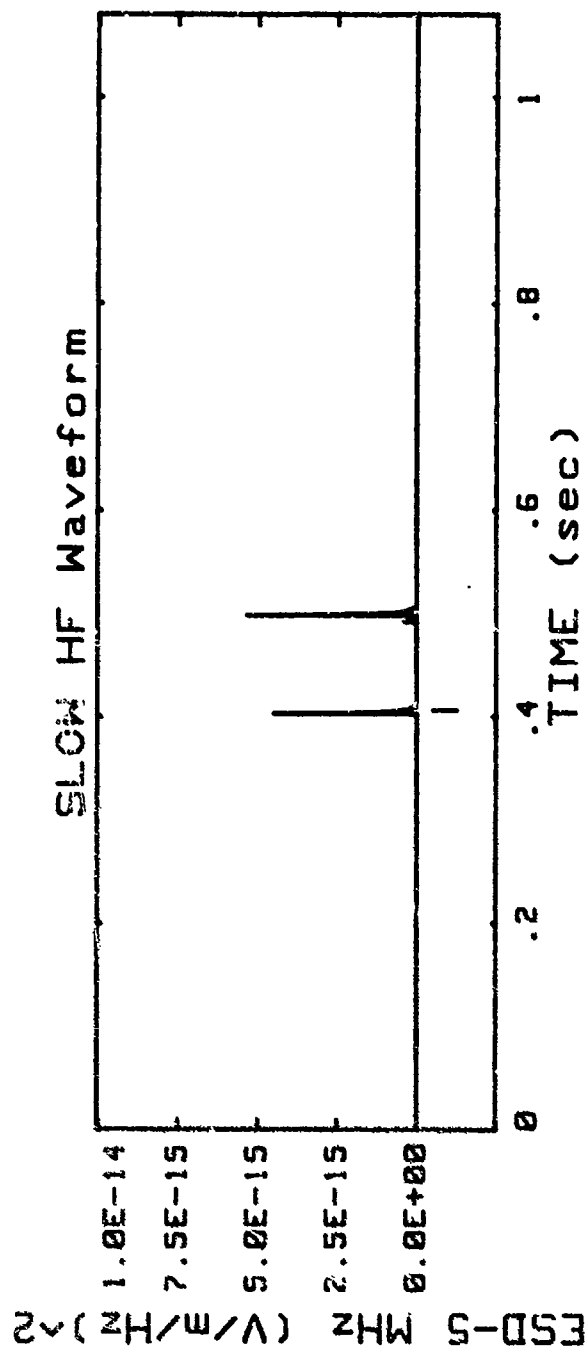
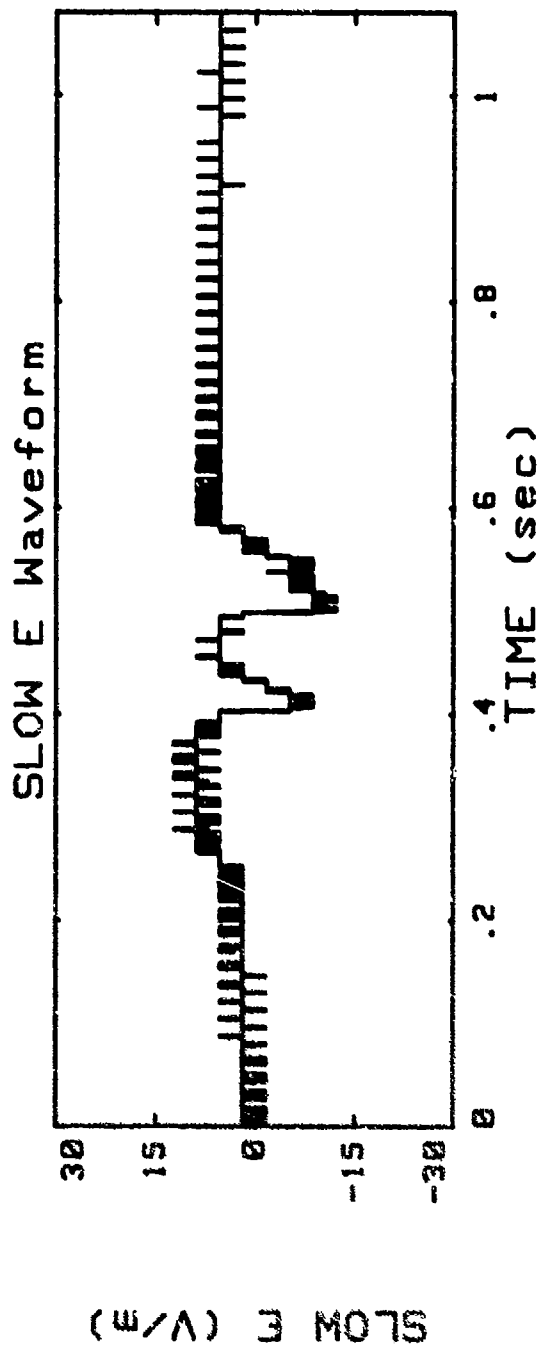


220201604.877 1985

1st RS (27.6 Km)

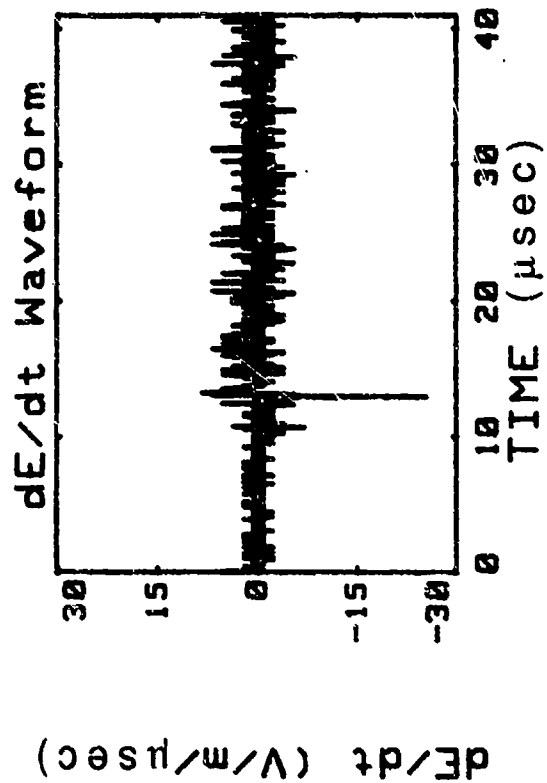
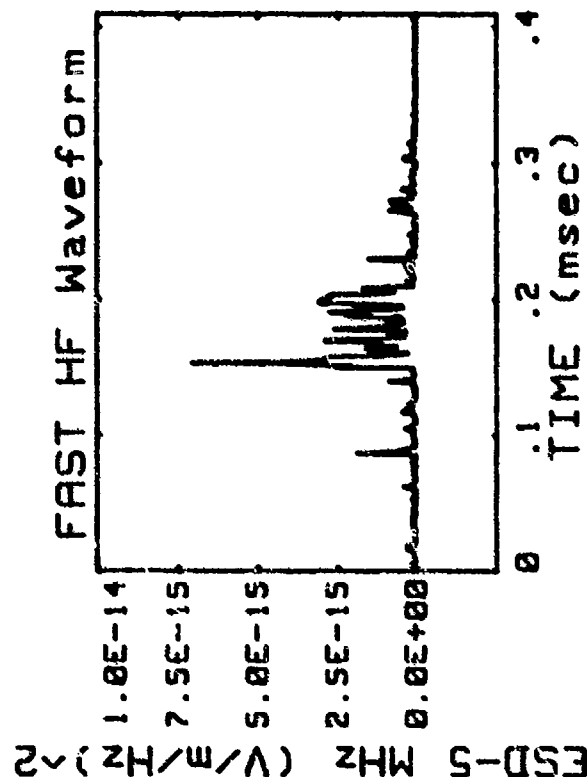
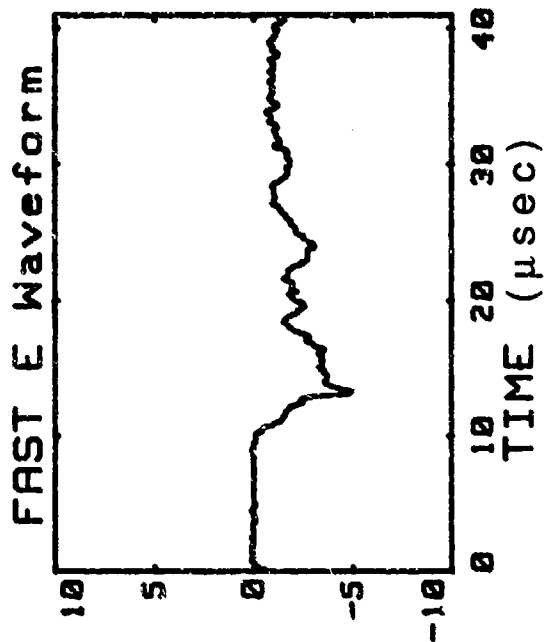
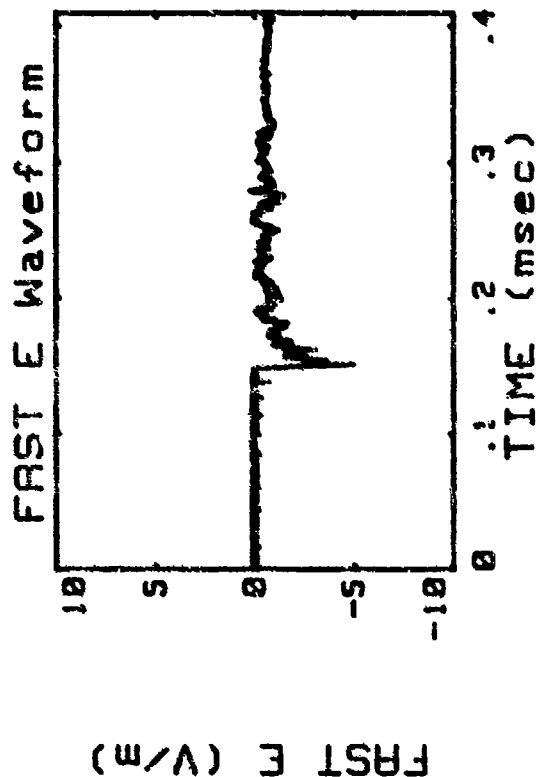


20:16:04.483 8 Aug 1985 (27.6 Km)

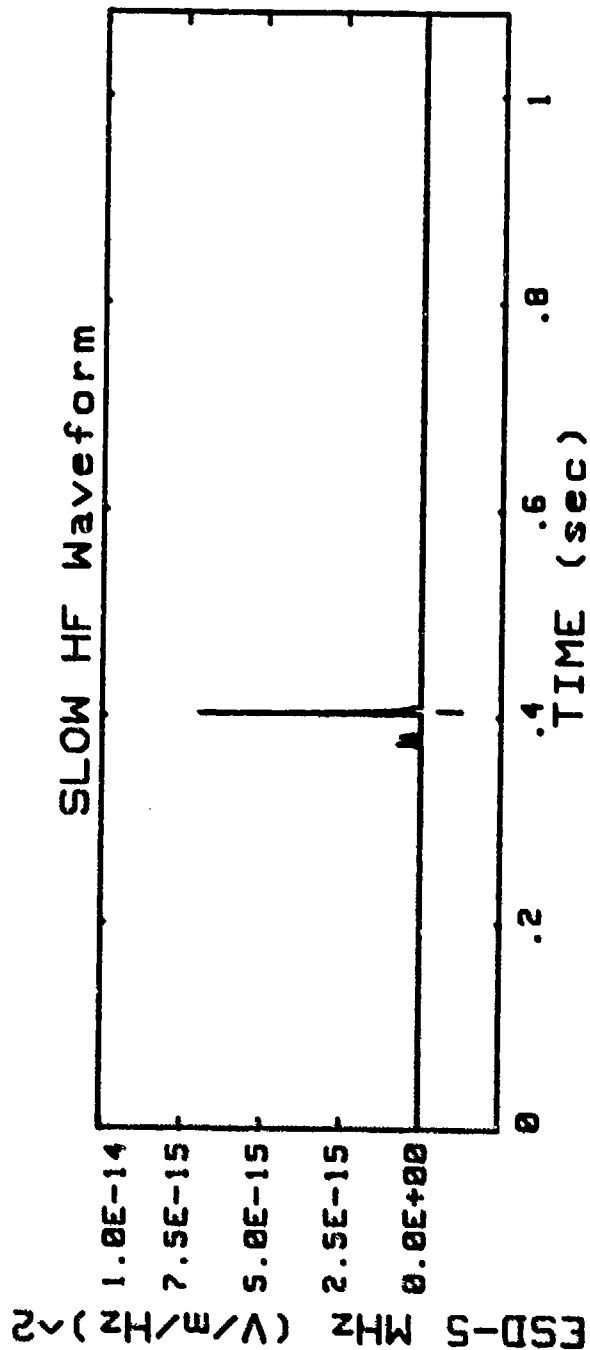
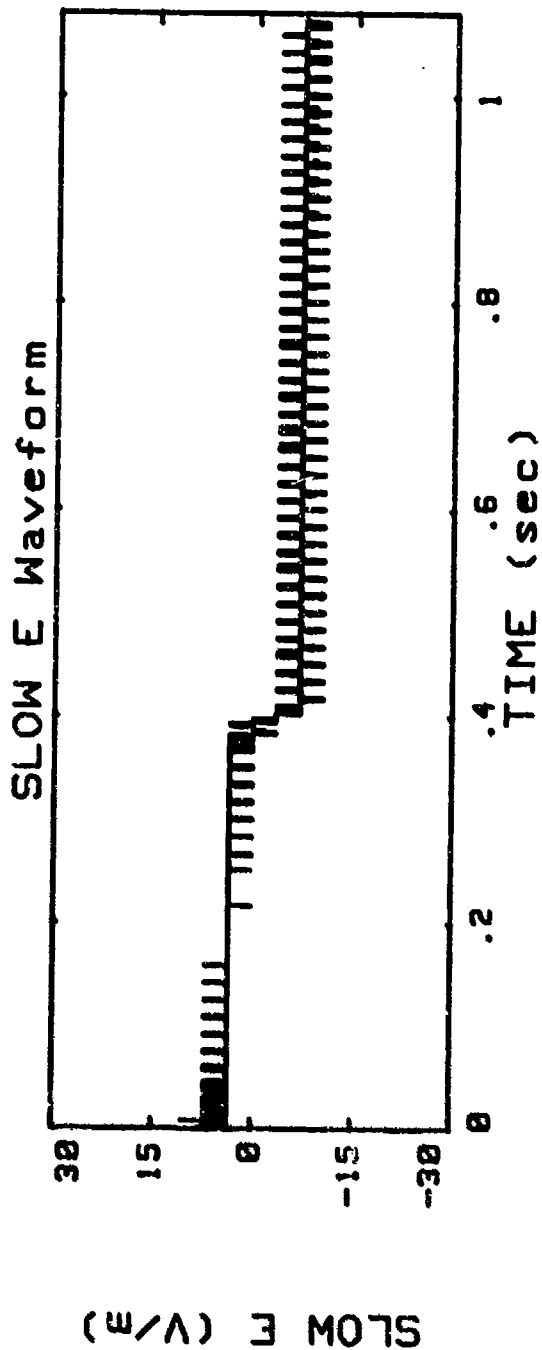


220201632.293 1985

1st RS (37.3 Km)

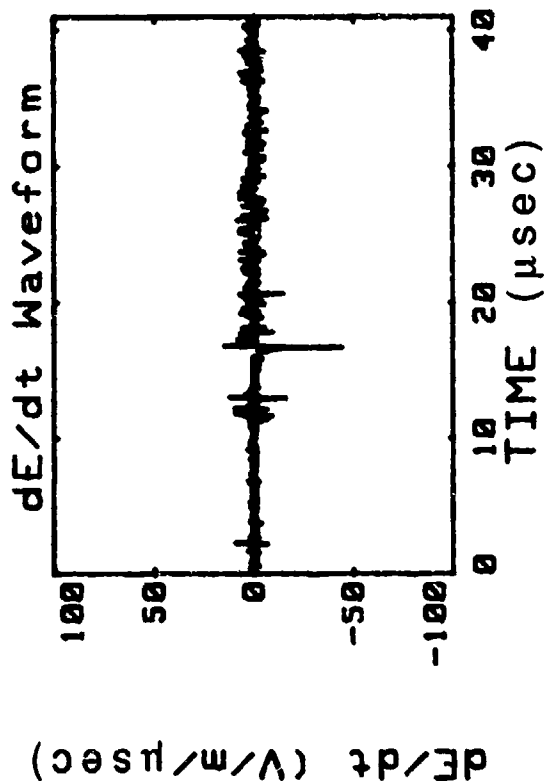
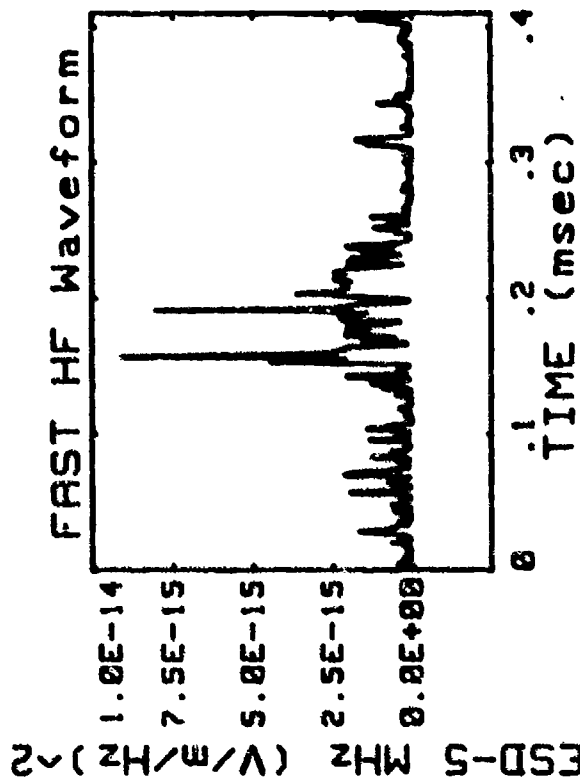
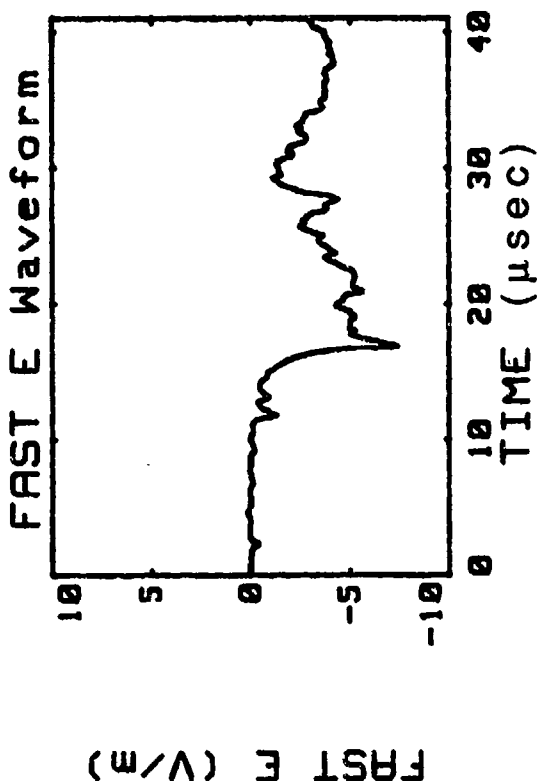
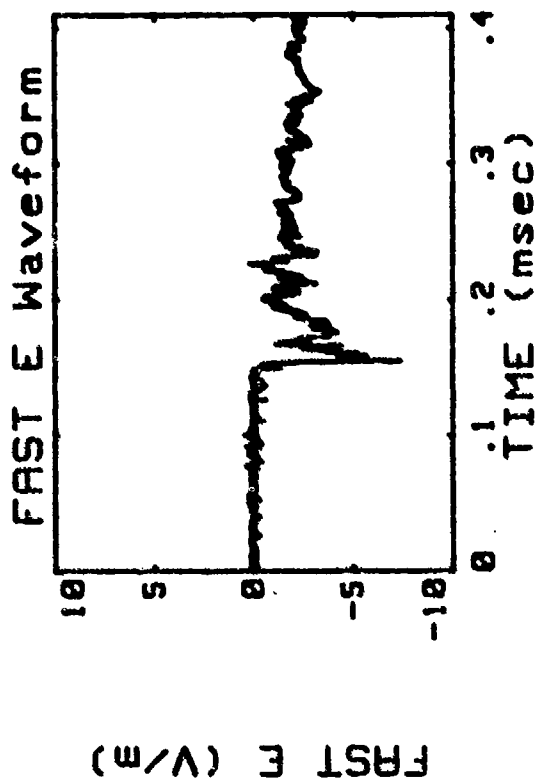


20:16:31.900 8 Aug 1985 (37.3 Km)

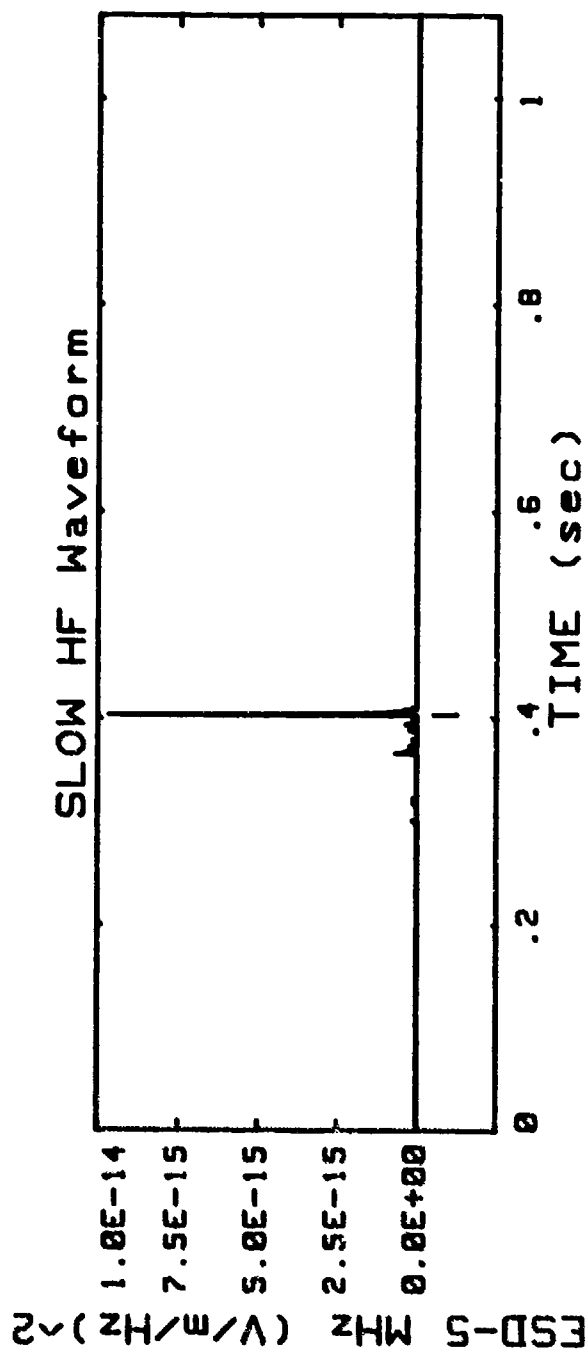
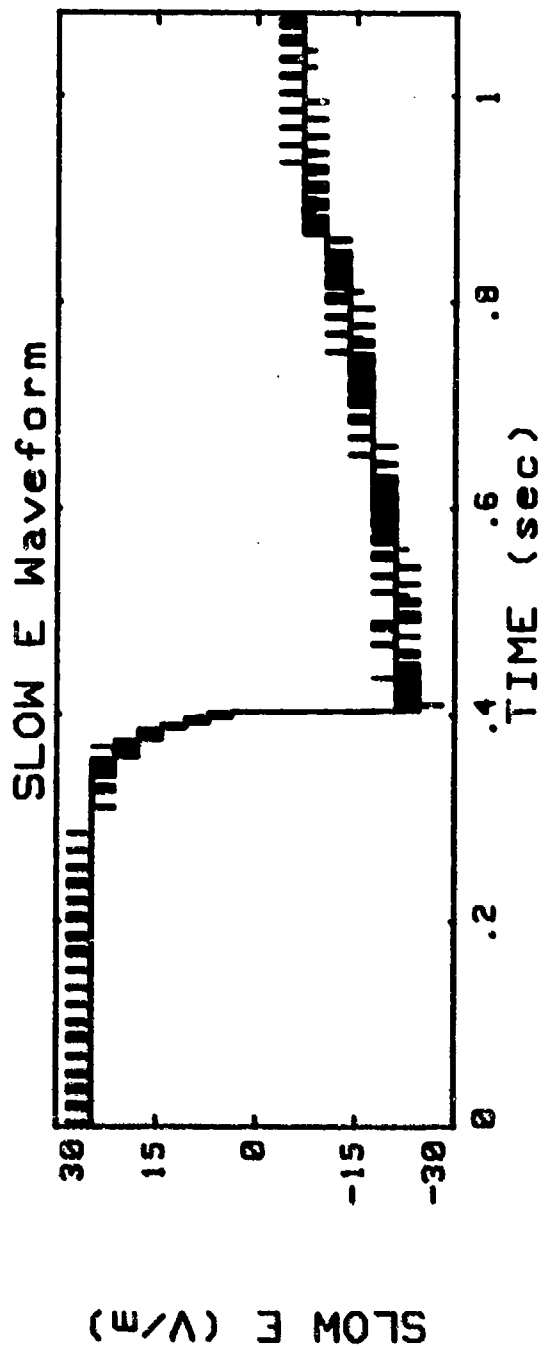


220201706.336 1985

1st RS (31.5 Km)

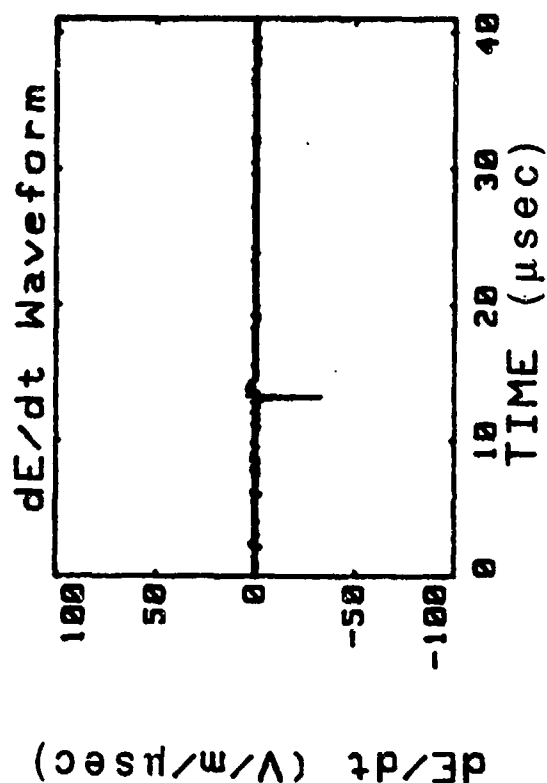
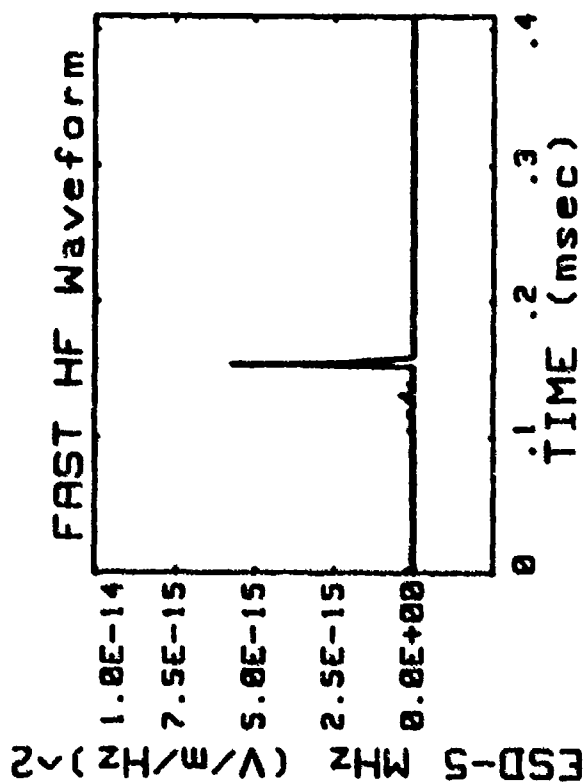
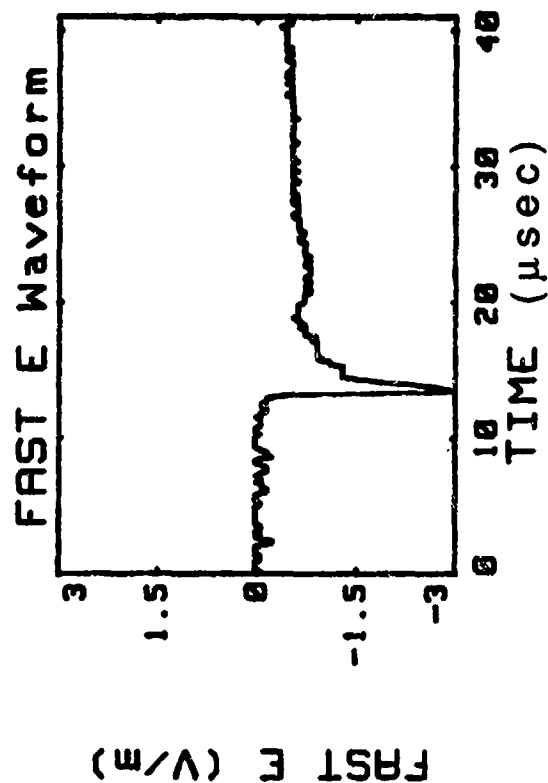
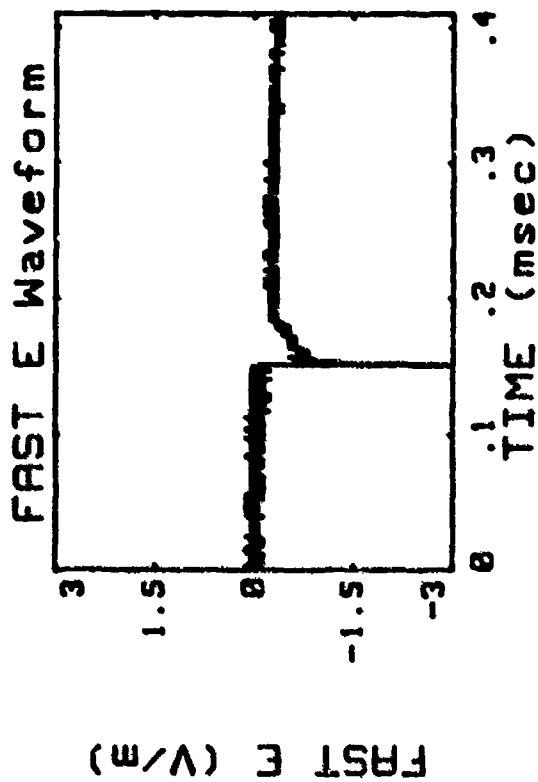


20:17:05.945 8 Aug 1985 (31.5 Km)



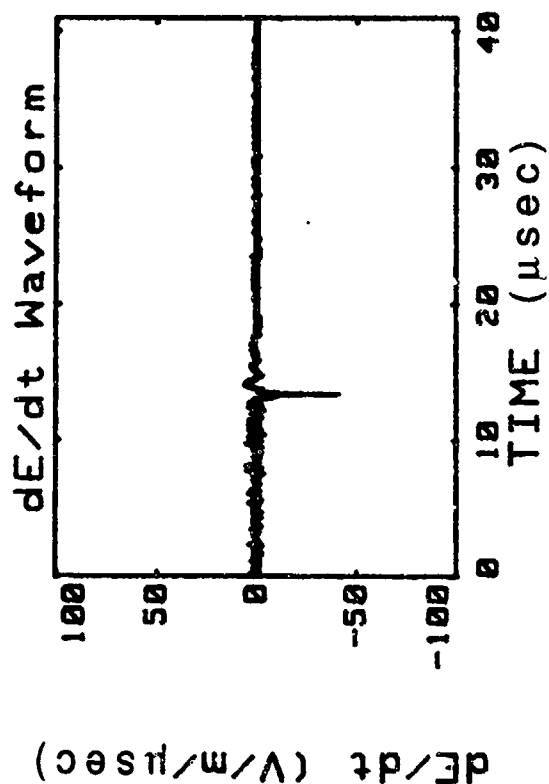
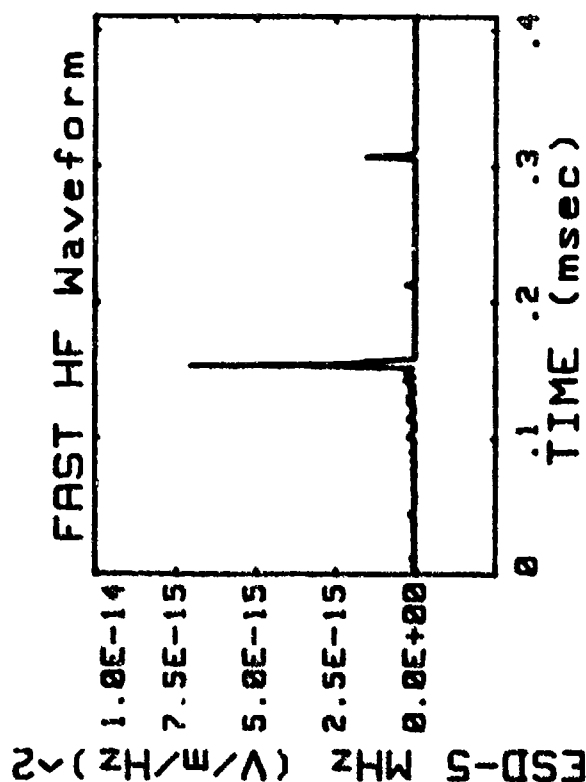
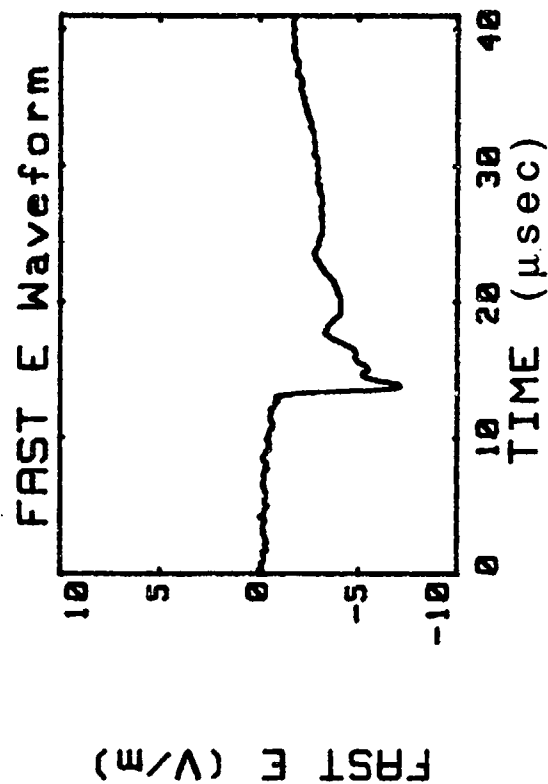
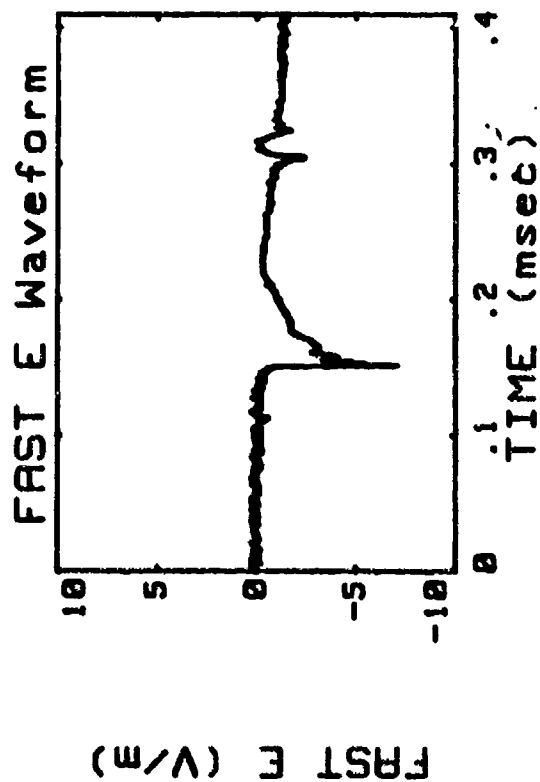
220201733.103 1985

DS Subs RS (28.1 Km)

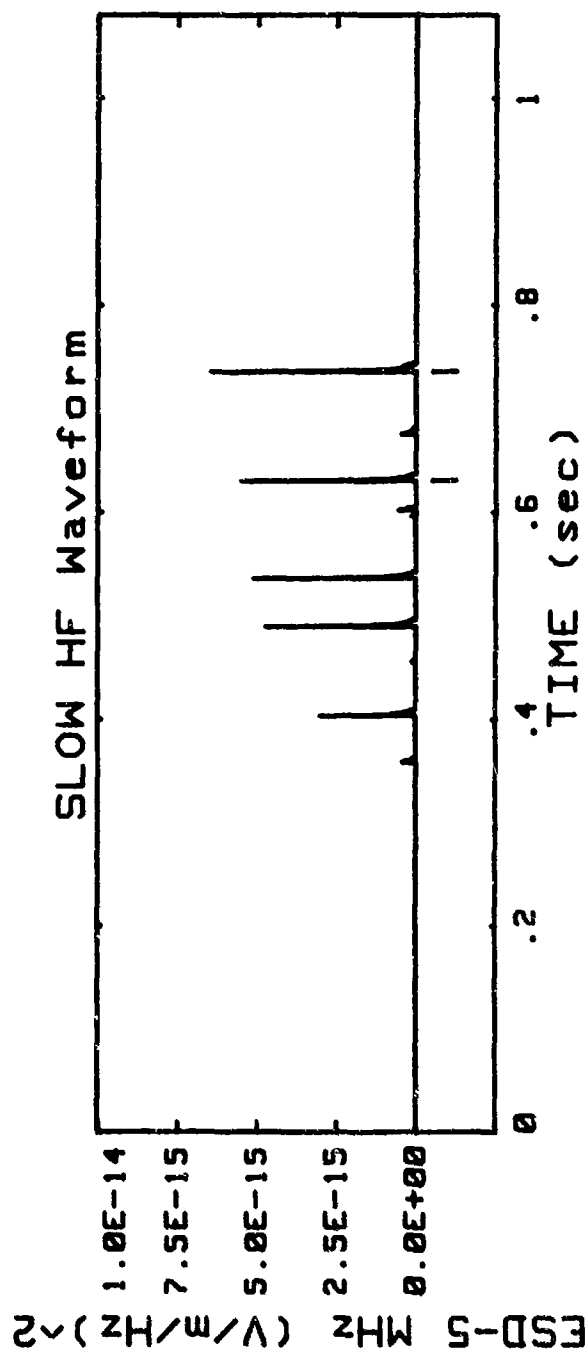
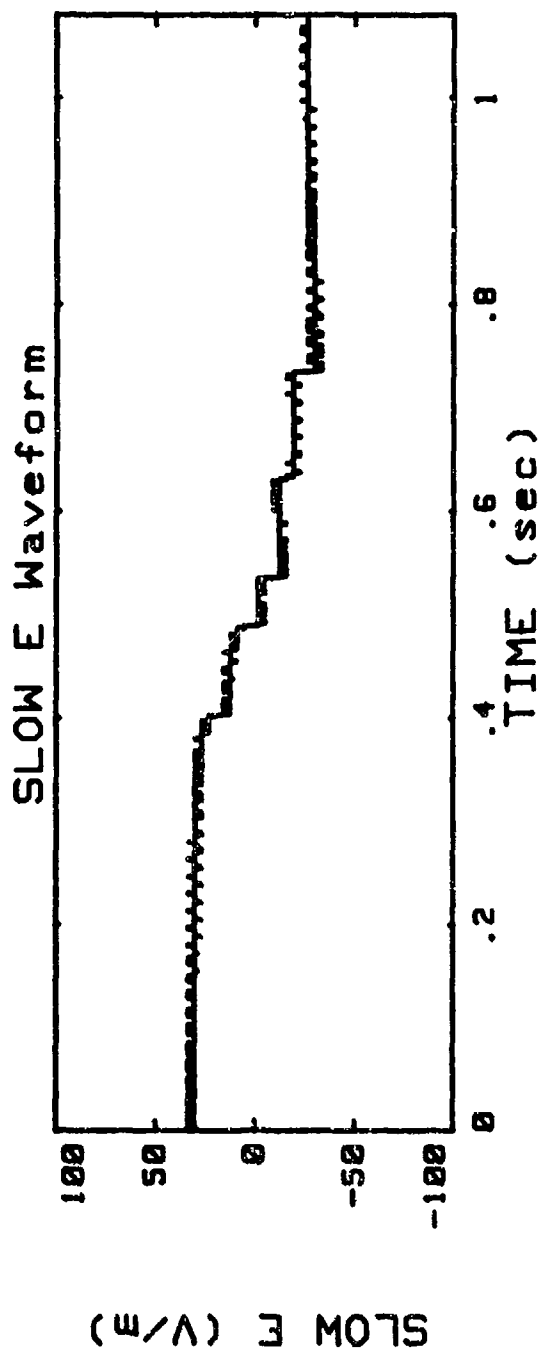


220201733.209 1985

Norm Subs RS (28.1 Km)

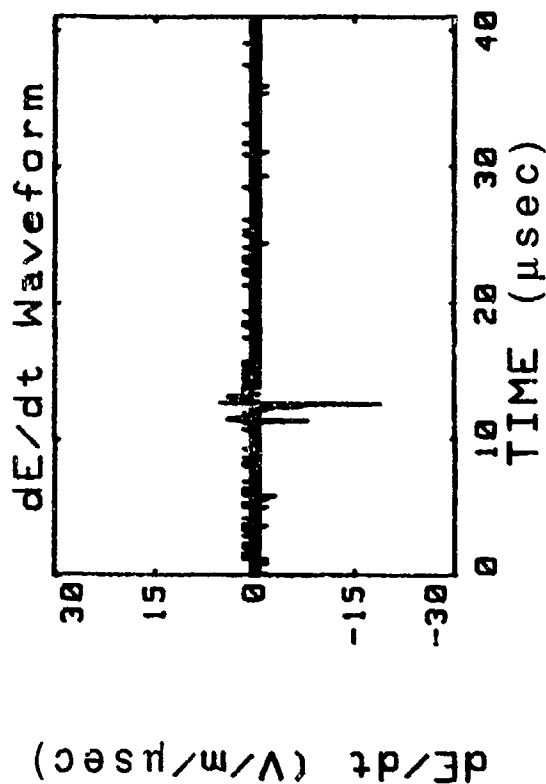
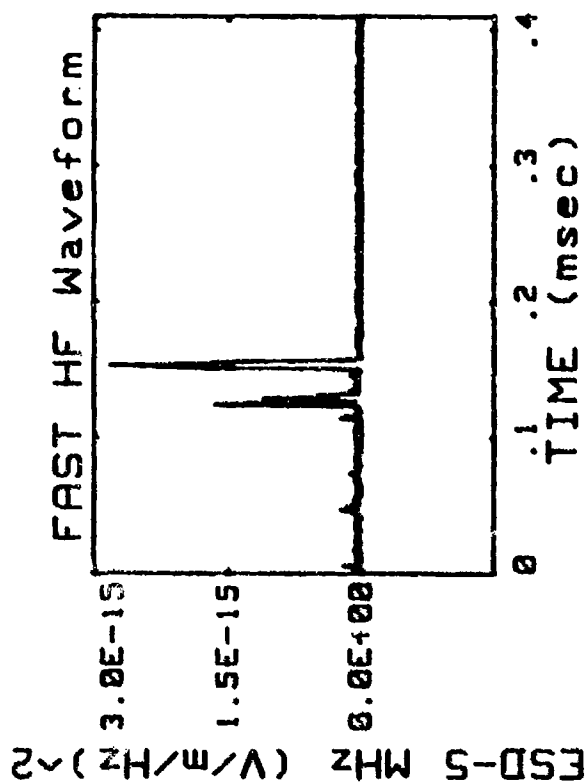
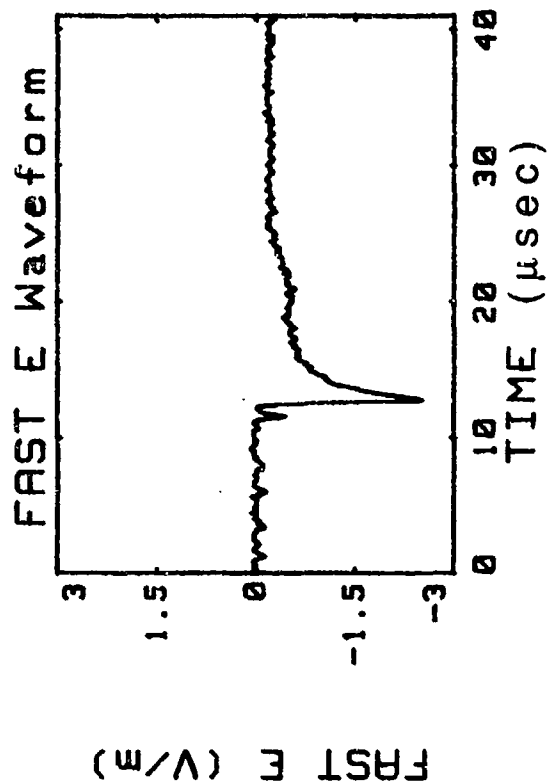
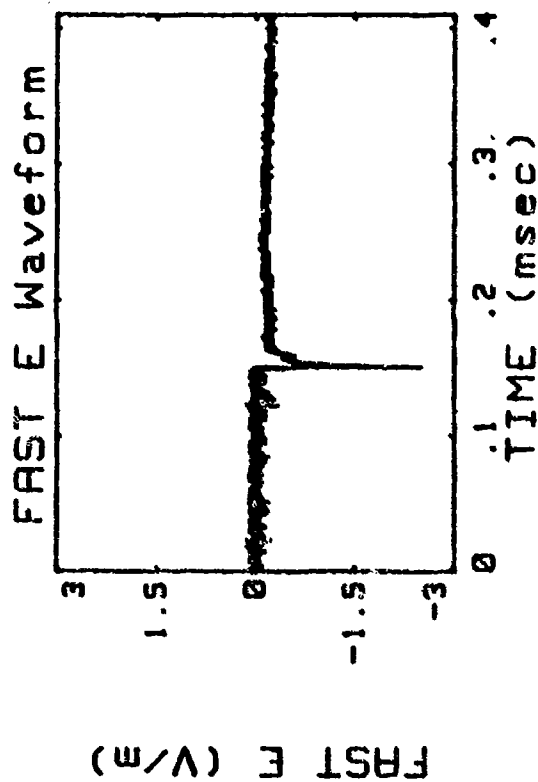


20:17:32.485 8 Aug 1985 (28.1 Km)

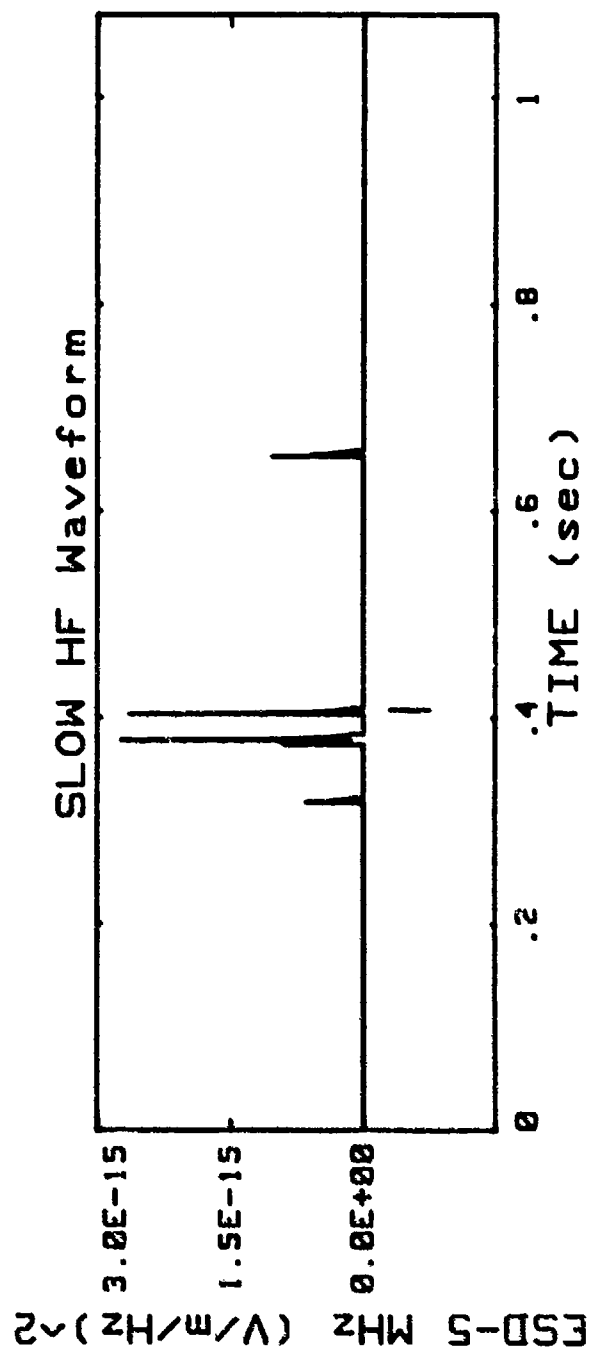
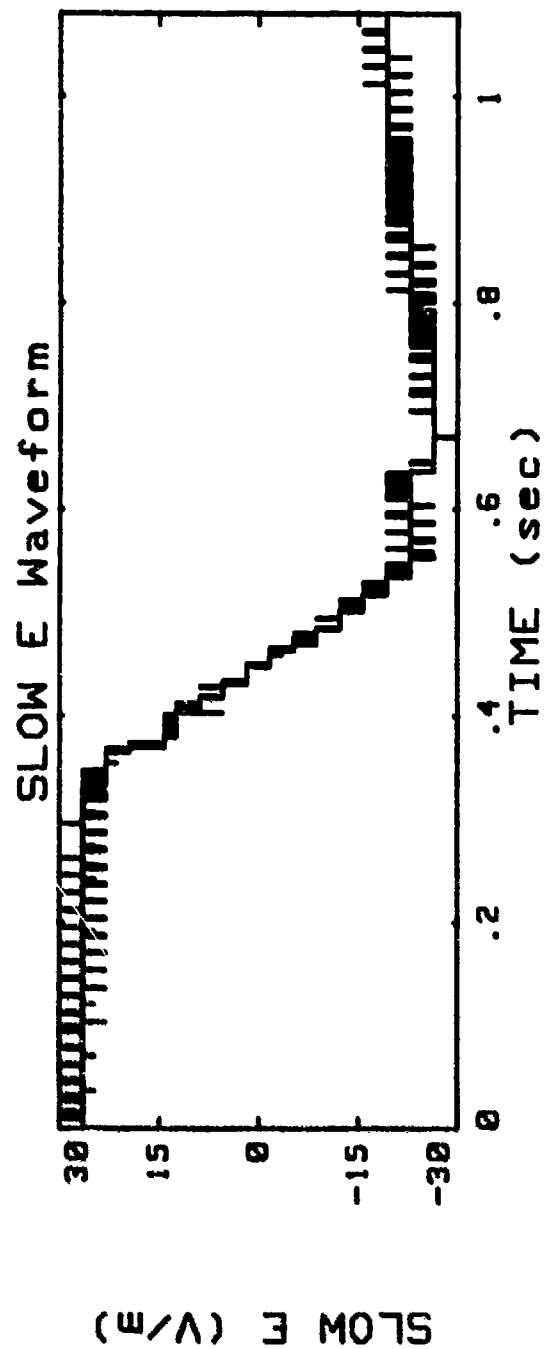


220201830.596 1985

DS Subs RS (29.2 Km)

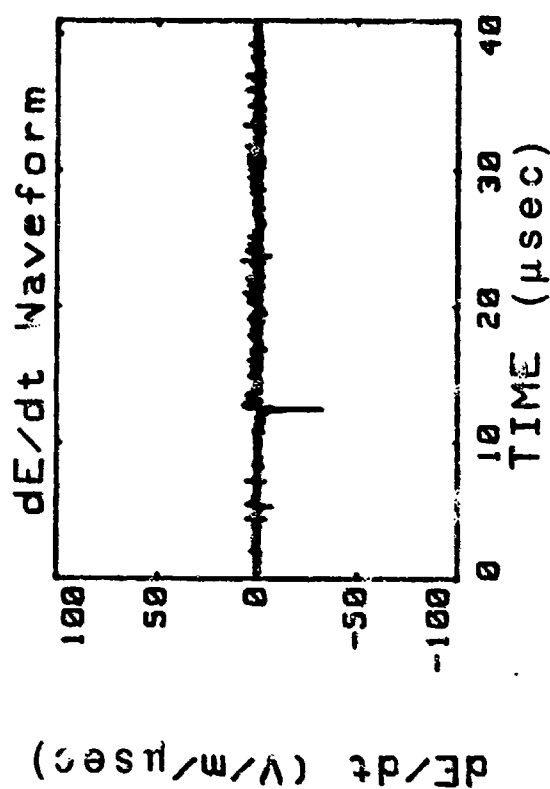
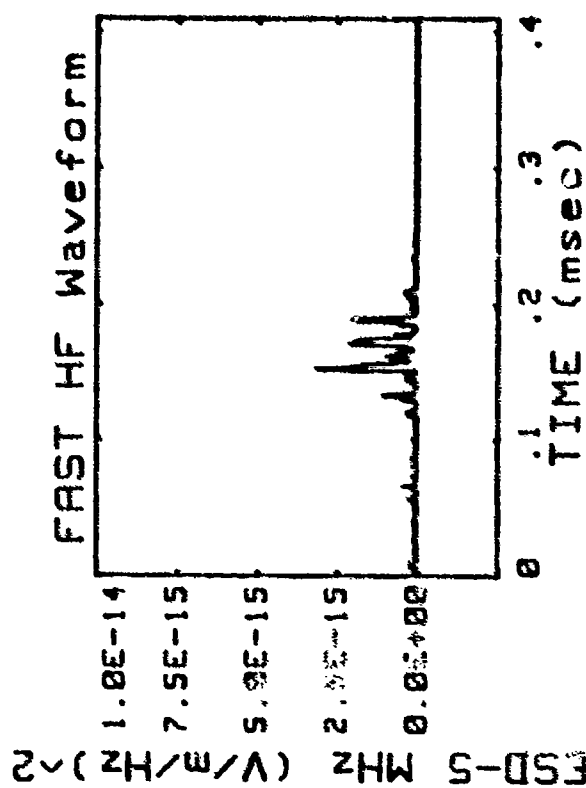
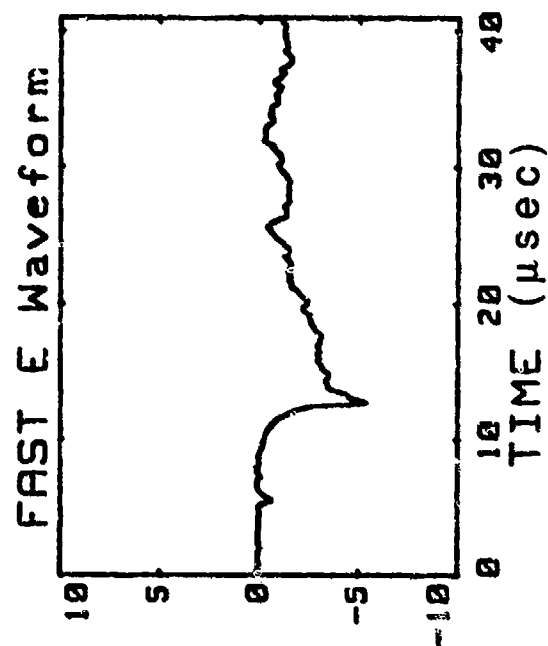
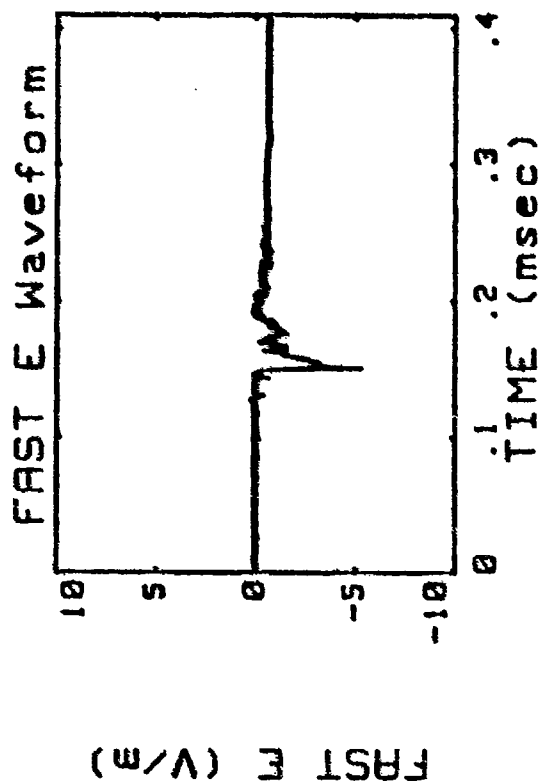


20:18:30.201 8 Aug 1985 (29.2 Km)



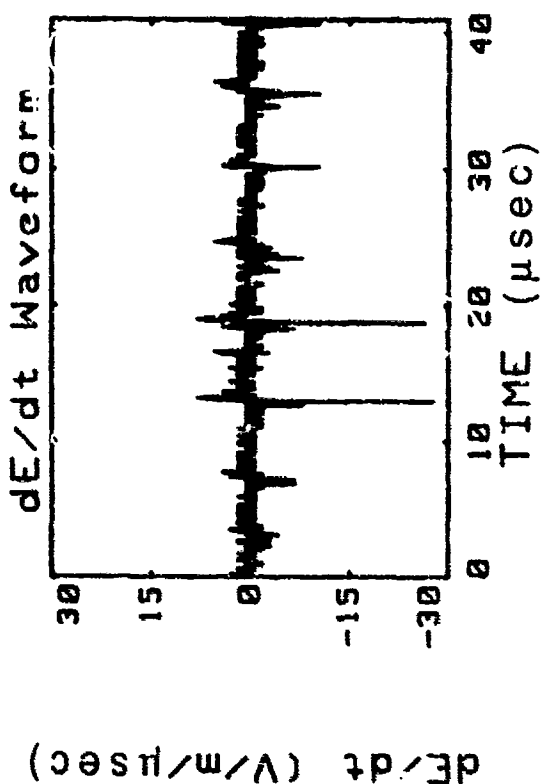
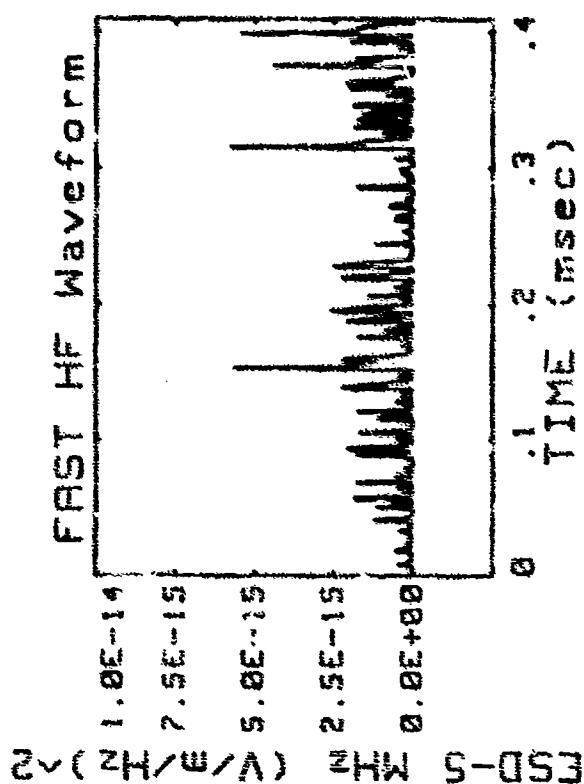
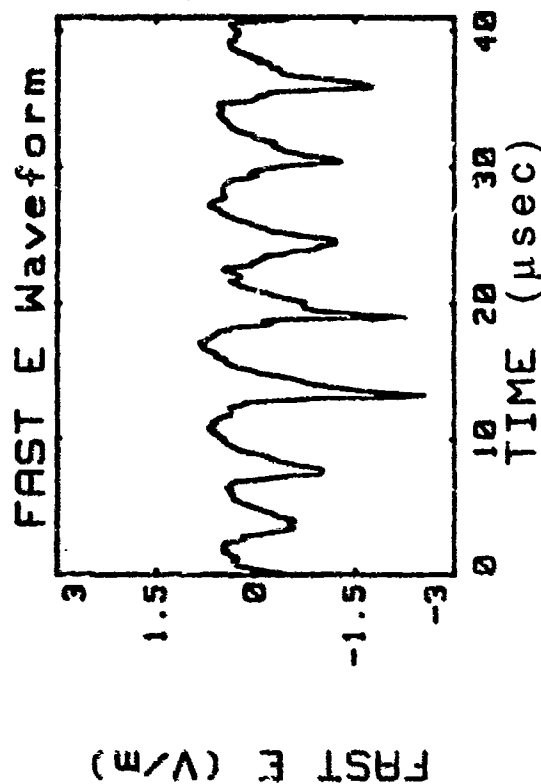
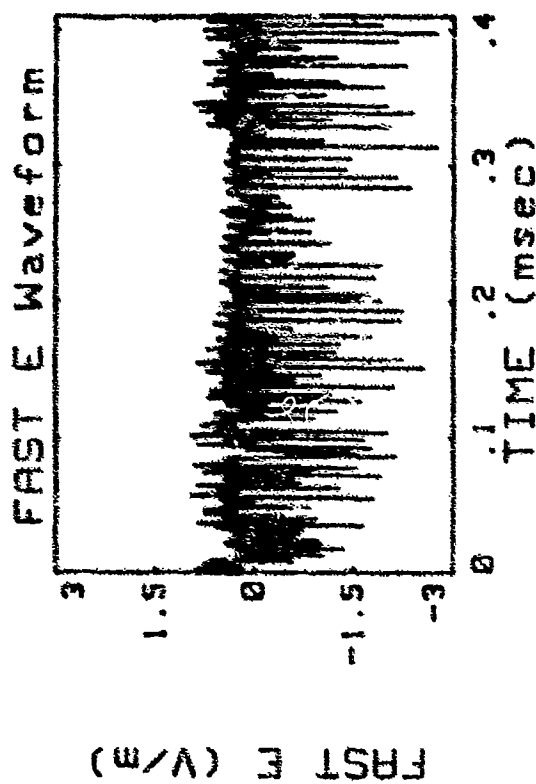
220201851.735 1985

1st RS (29.8 Km)

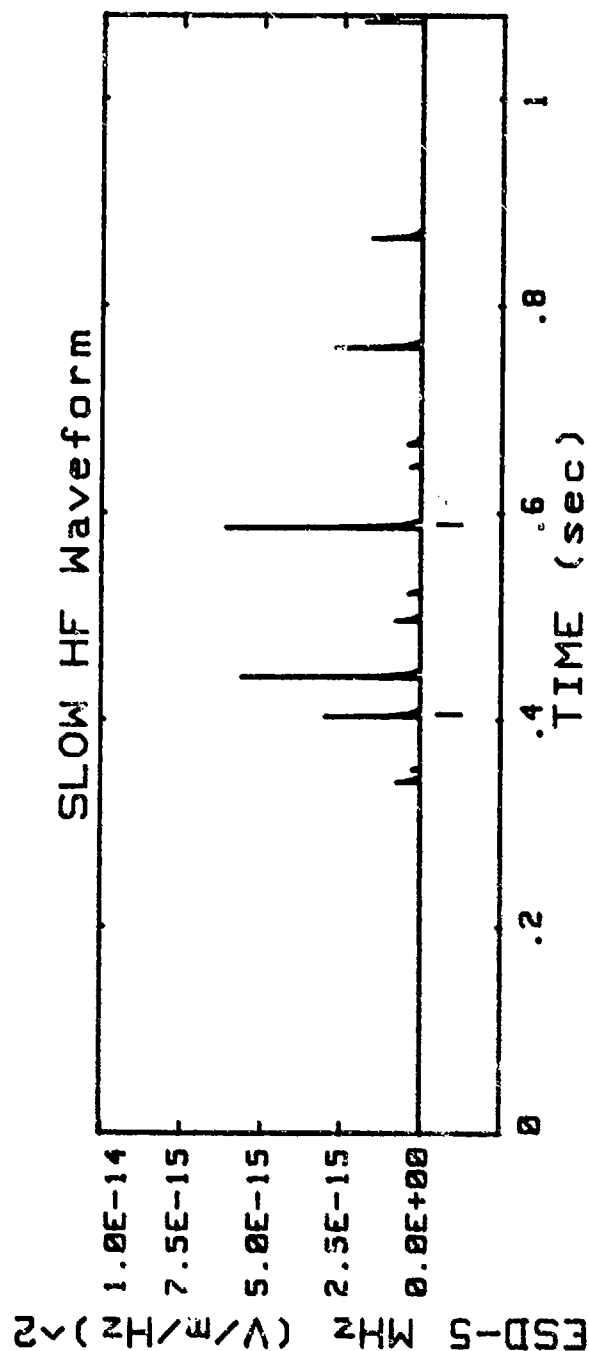
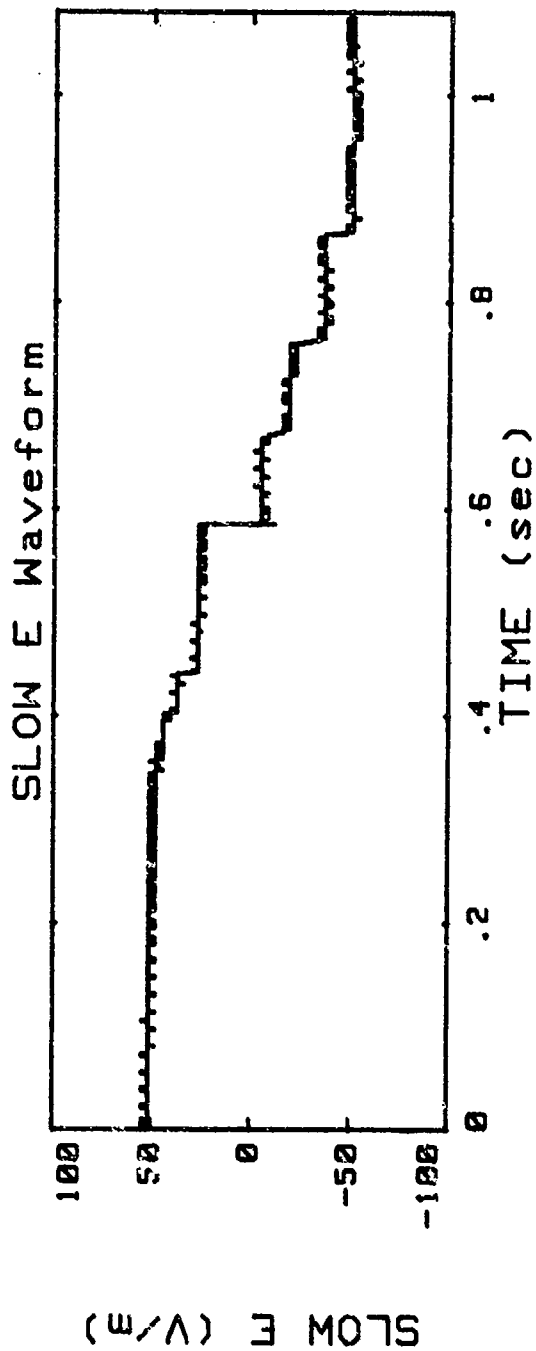


220201851.919 1985

DS Leader (29.8 Km)

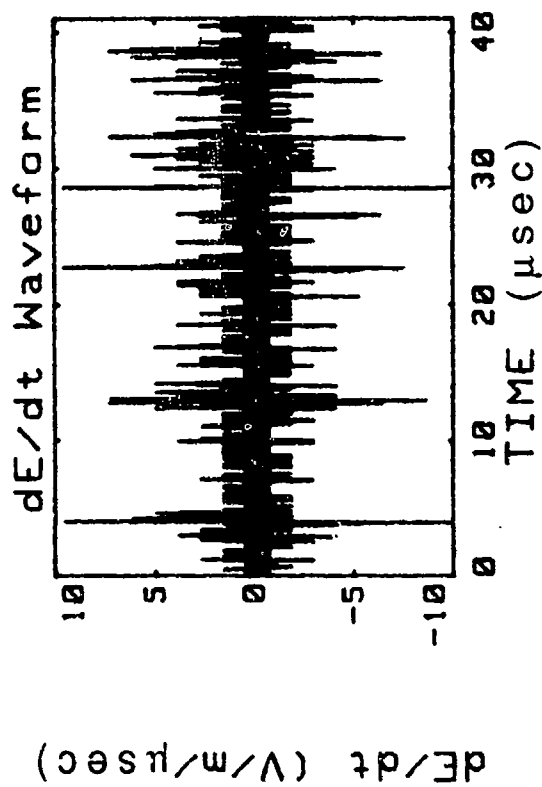
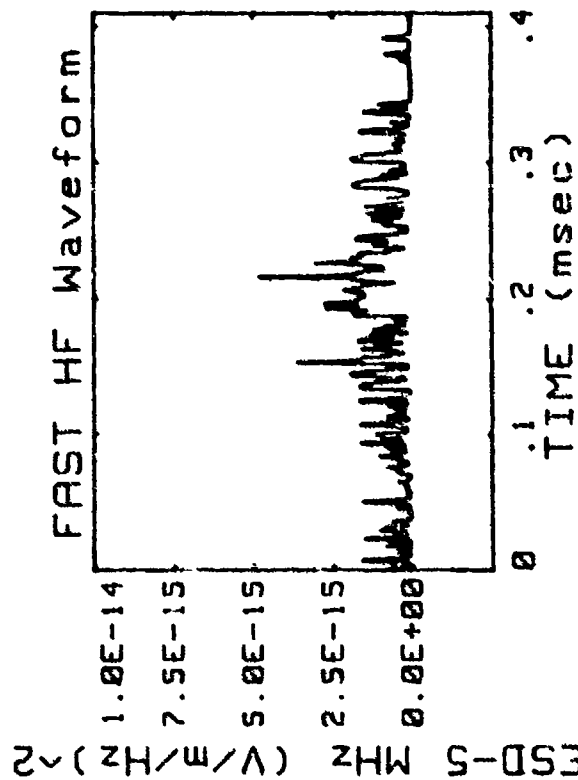
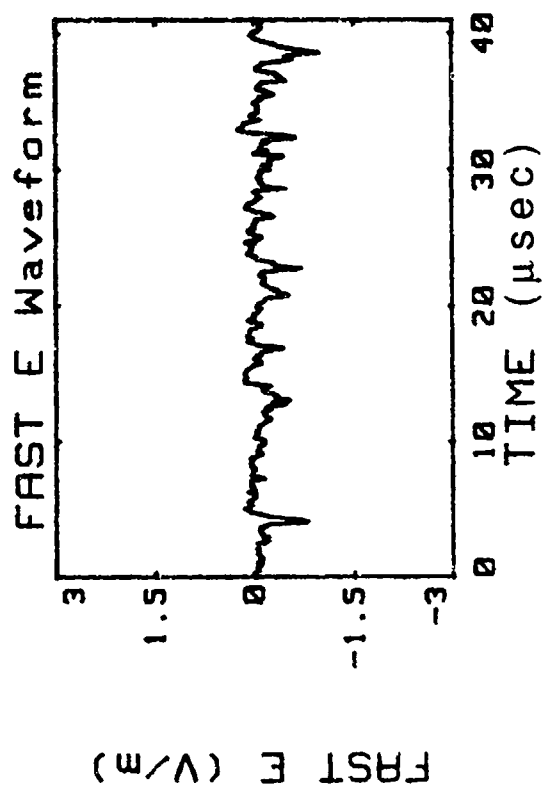
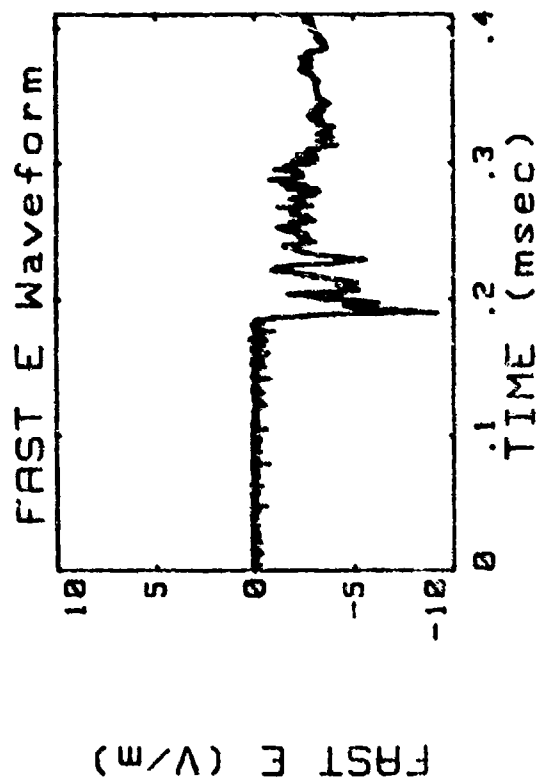


20:18:51.342 8 Aug 1985 (29.8 Km)

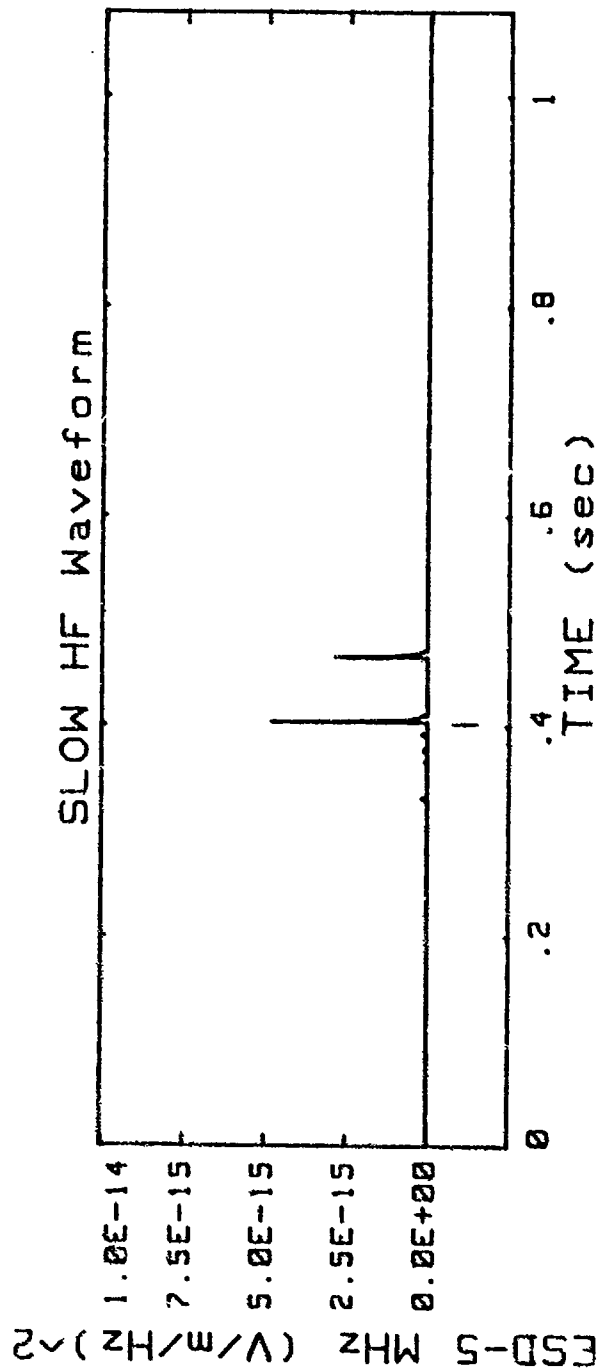
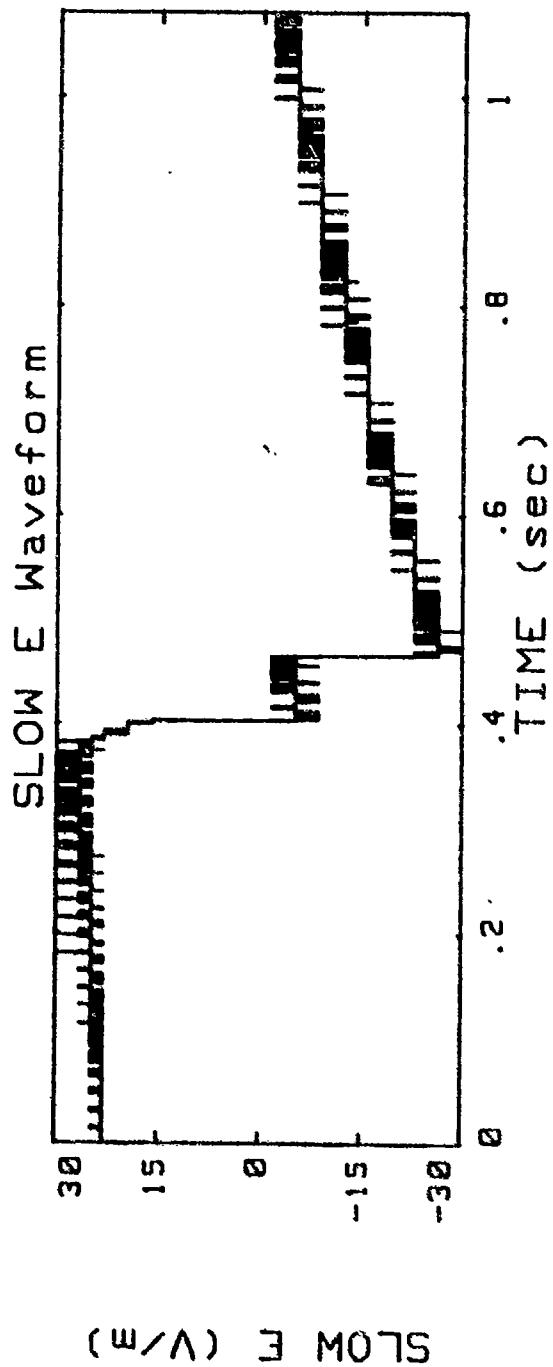


220201859.711 1965

Stepped Leader (27.6 Km)

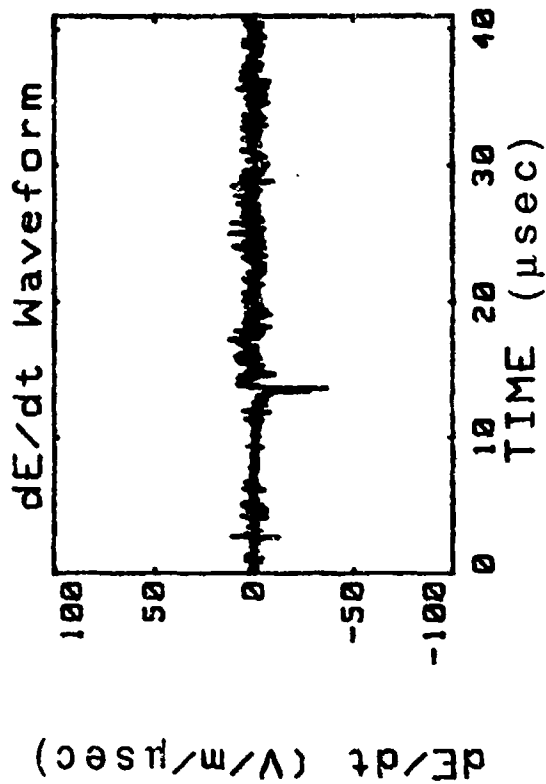
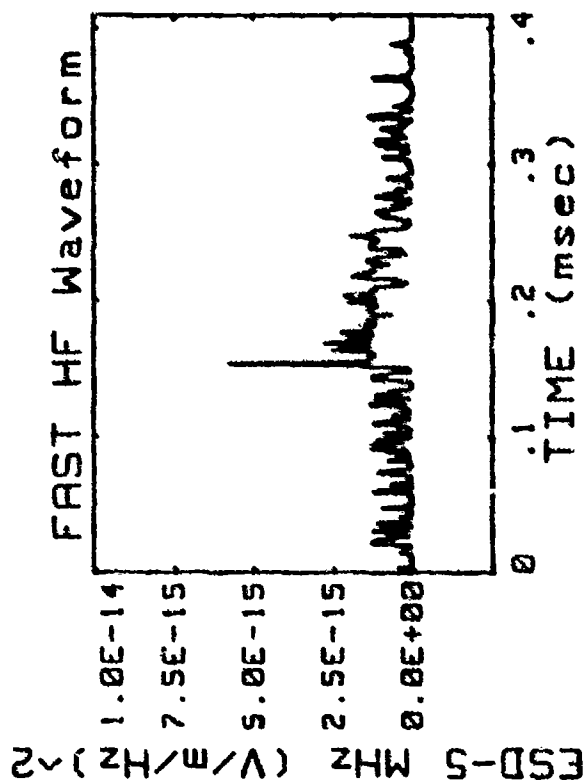
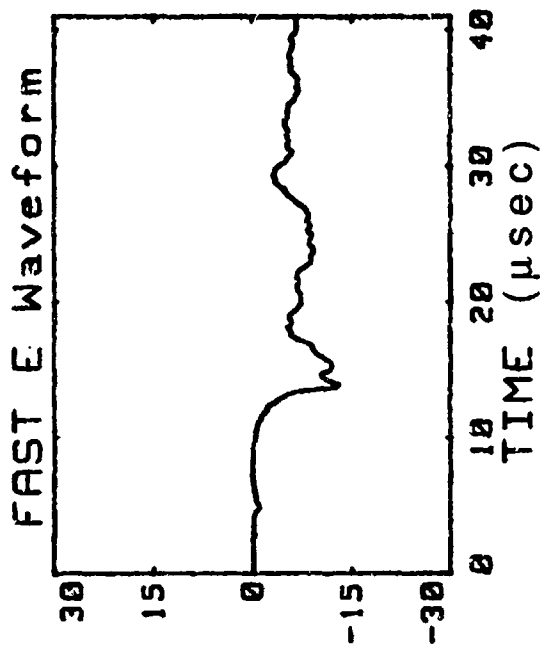
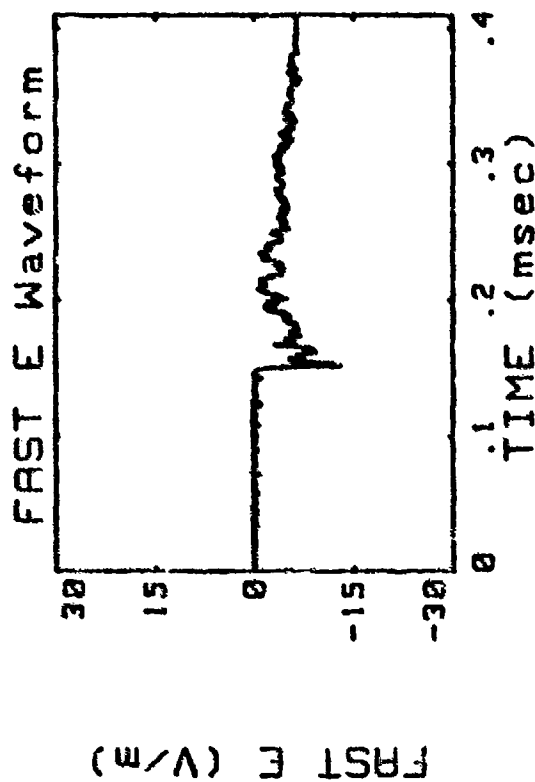


20:18:59.316 8 Aug 1985 (27.6 Km)

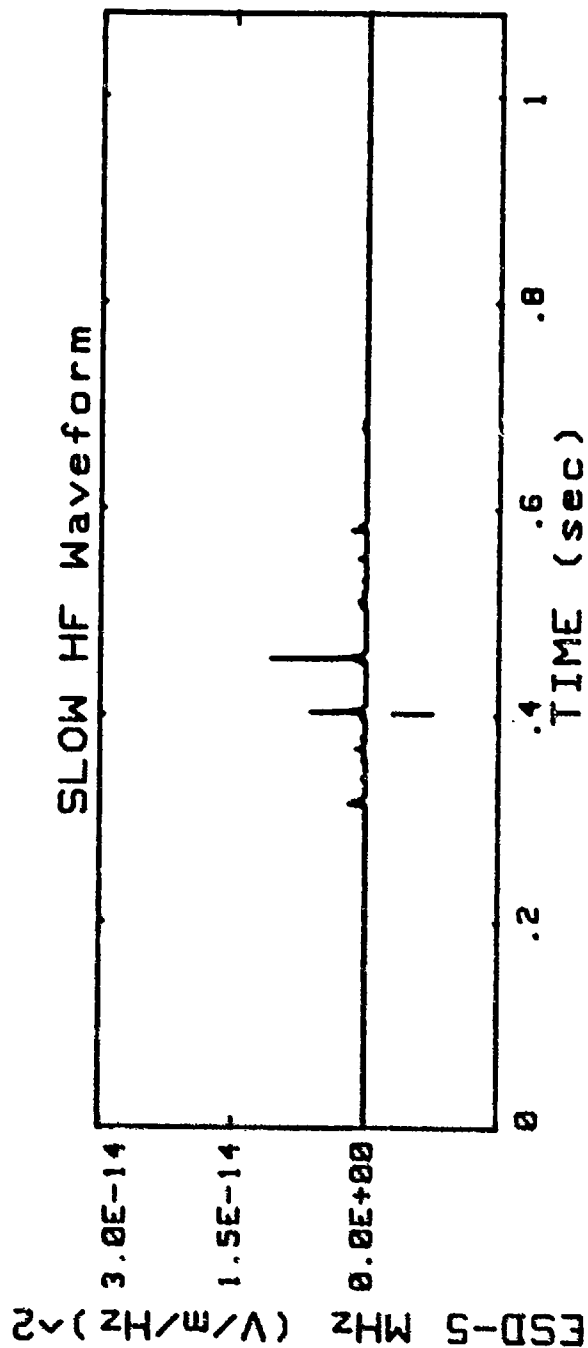
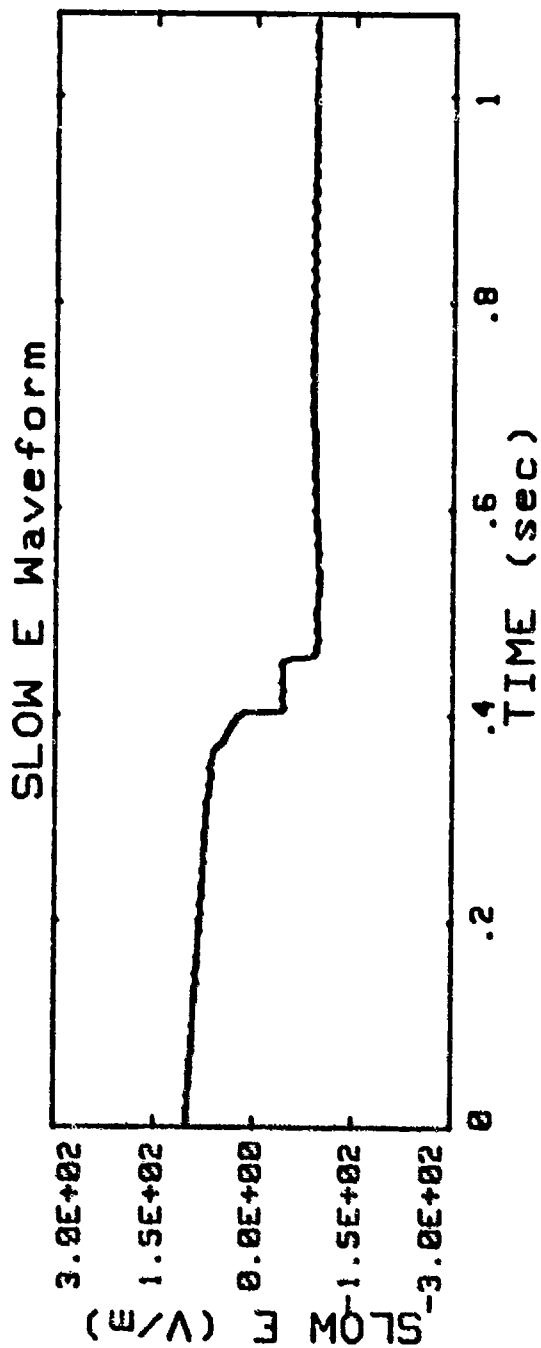


220201910.250 1985

1st RS (23.9 Km)

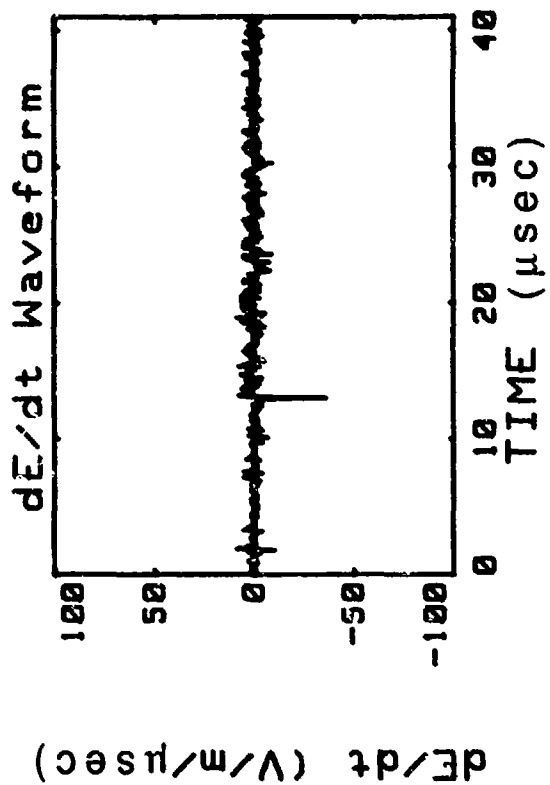
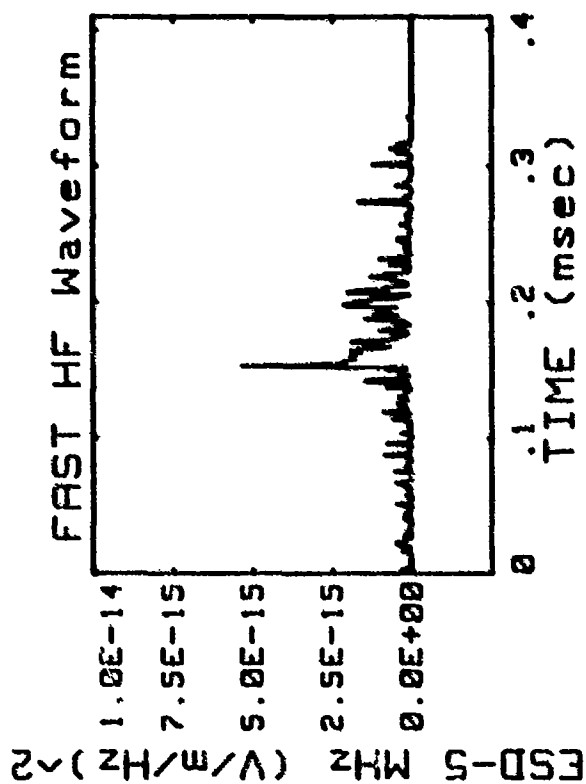
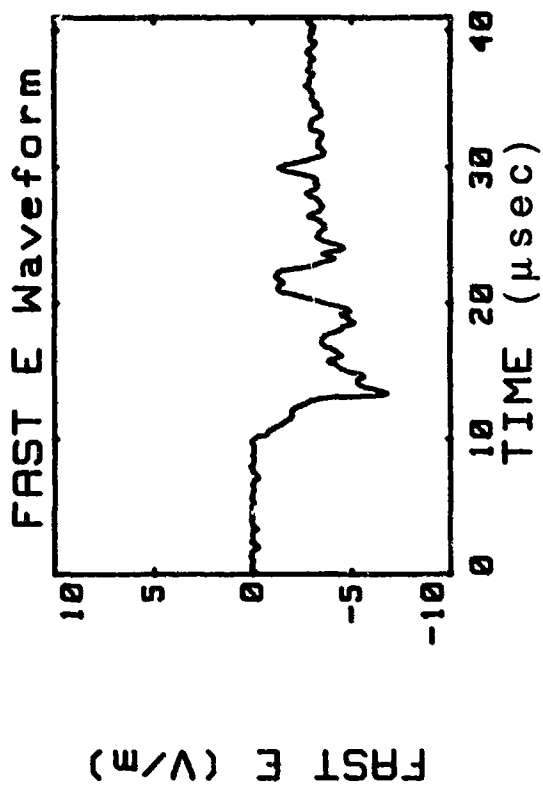
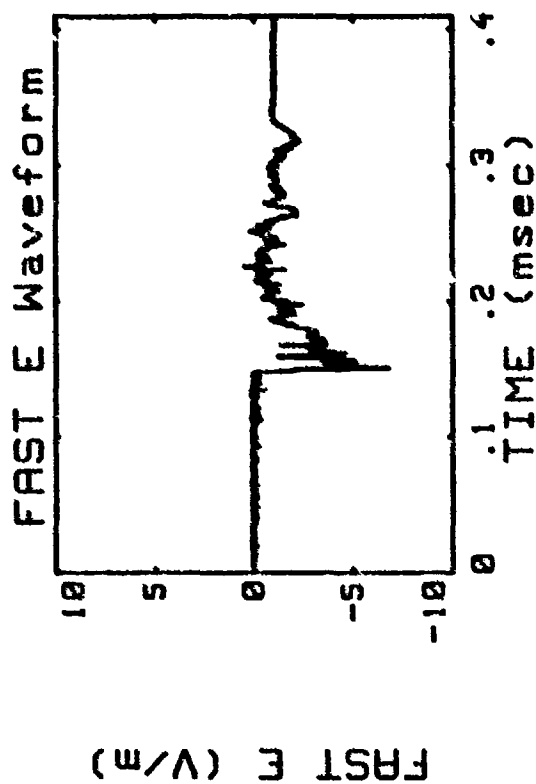


20:19:09.869 8 Aug 1985 (23.9 Km)

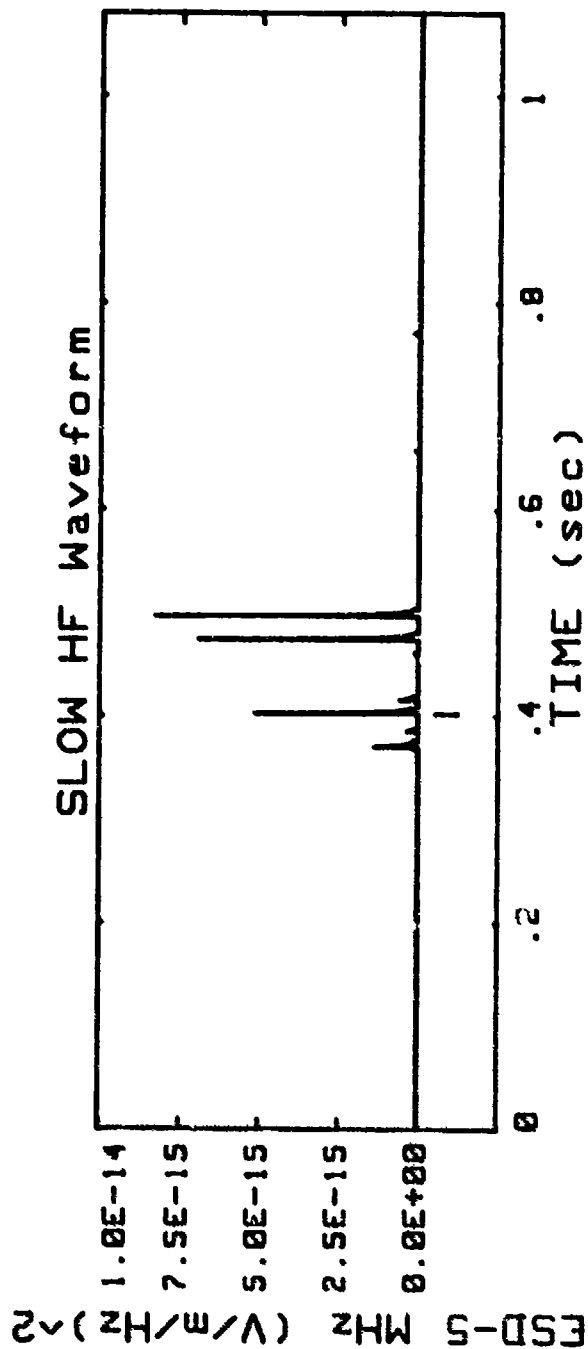
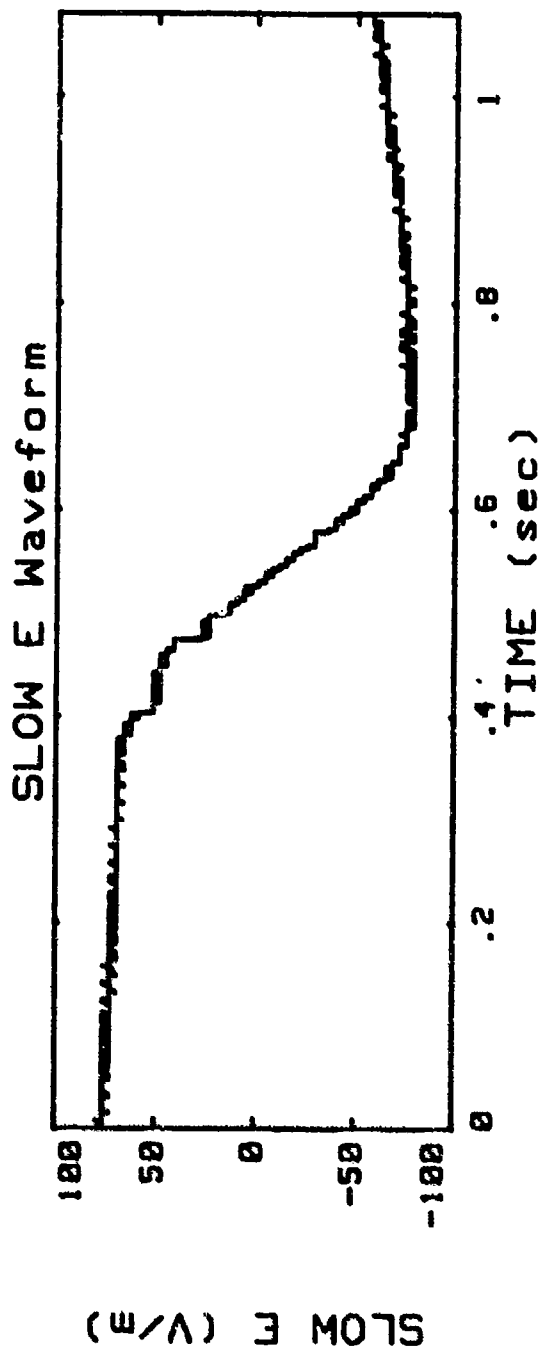


220201934.333 1985

1st RS (29.7 Km)

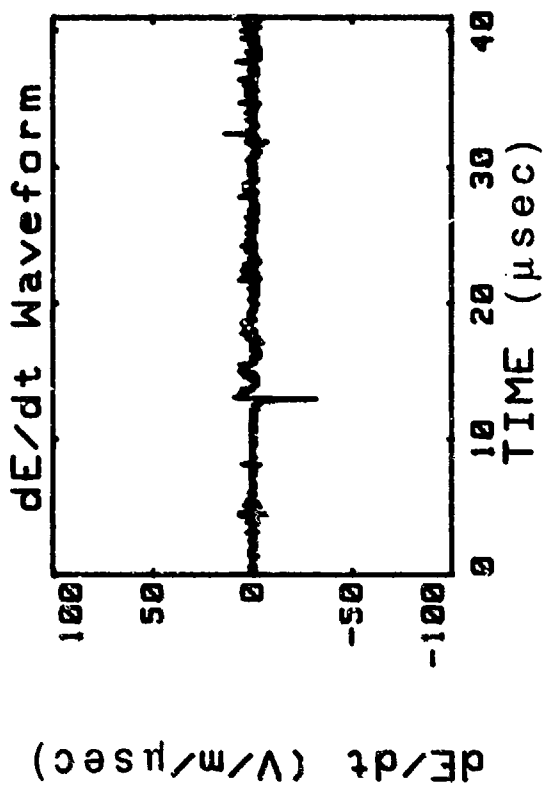
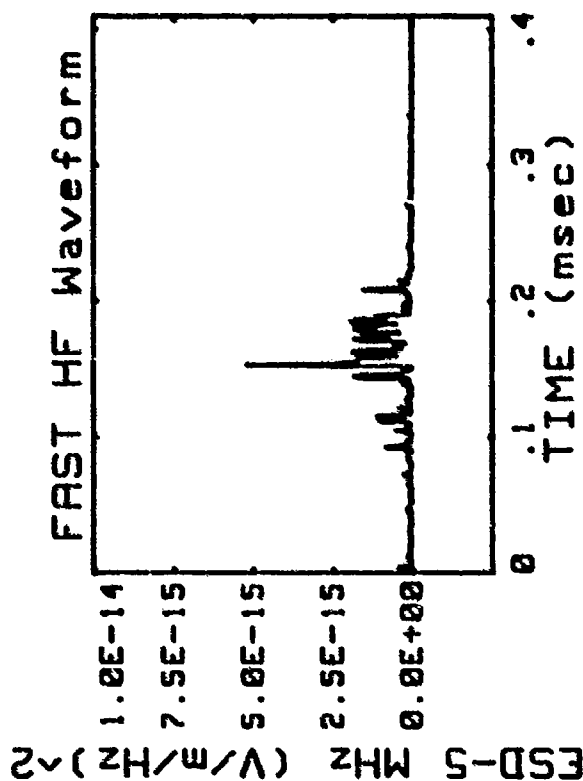
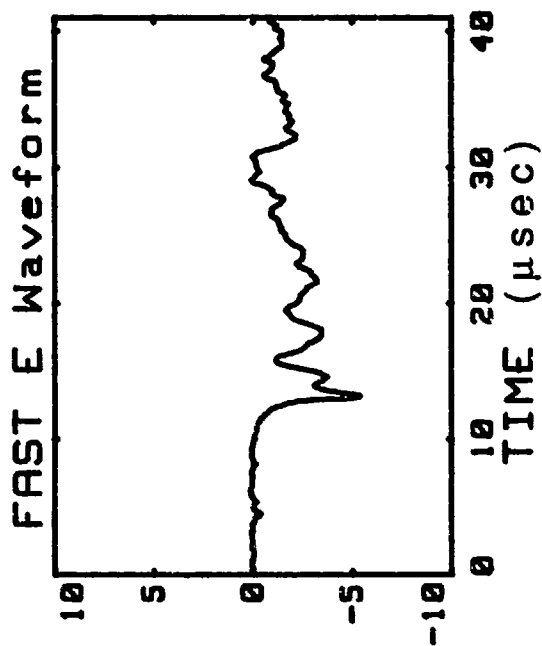
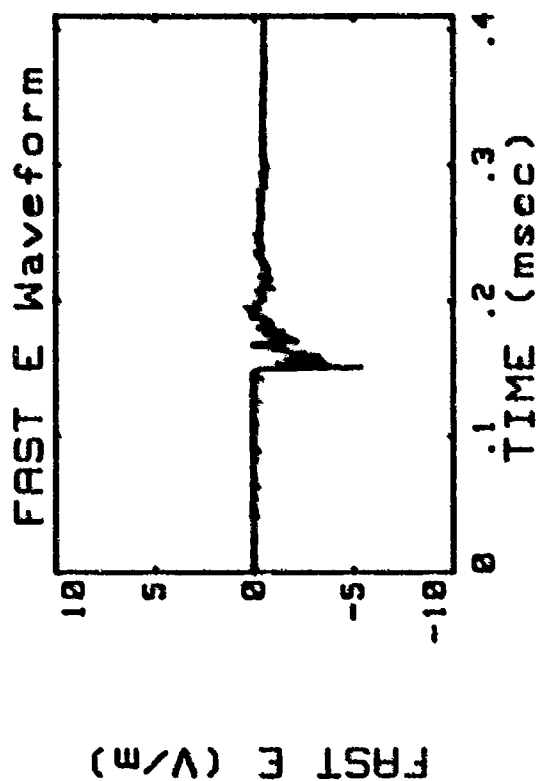


20:19:33.943 8 Aug 1985 (29.7 Km)



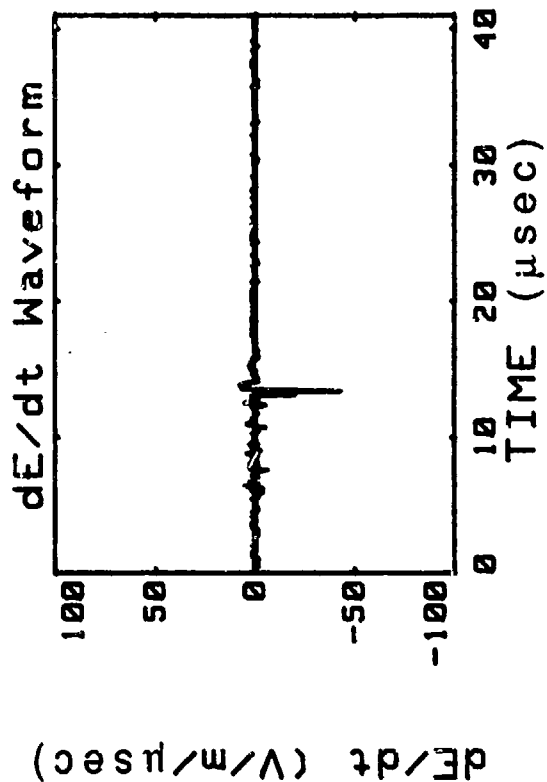
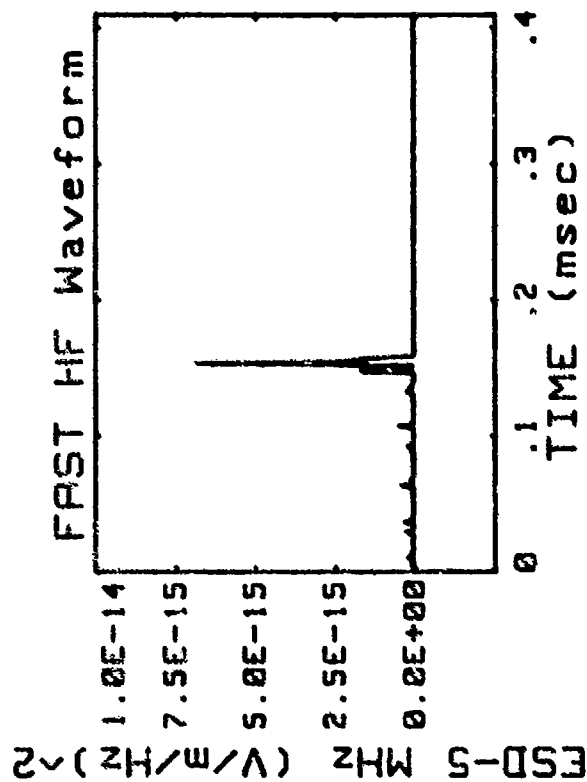
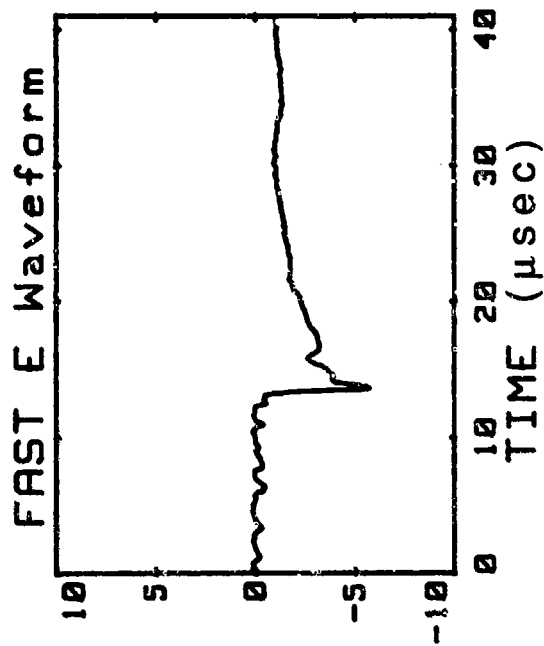
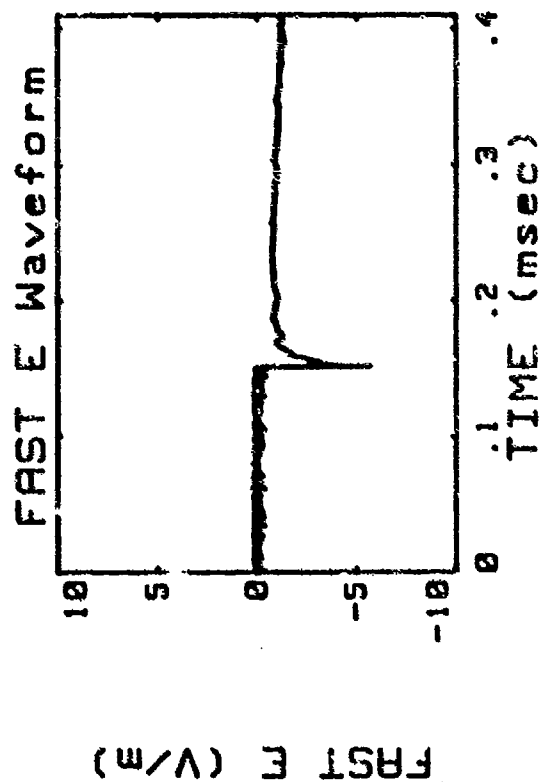
220202012.674 1985

1st RS (29.5 Km)

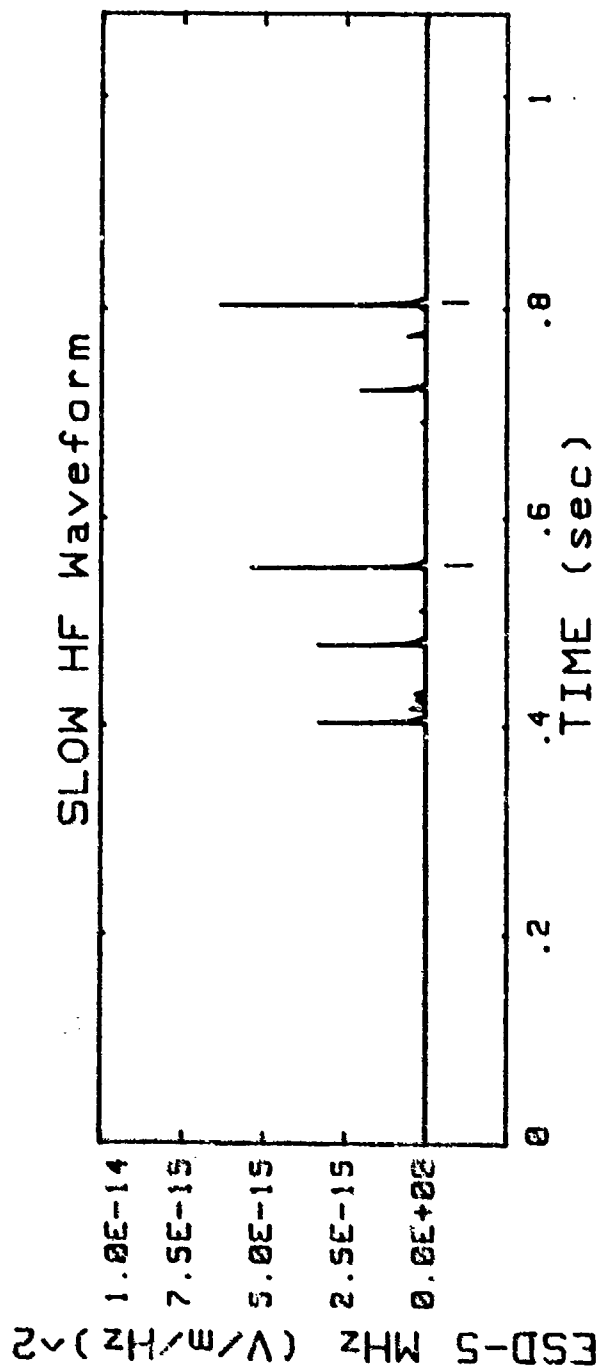
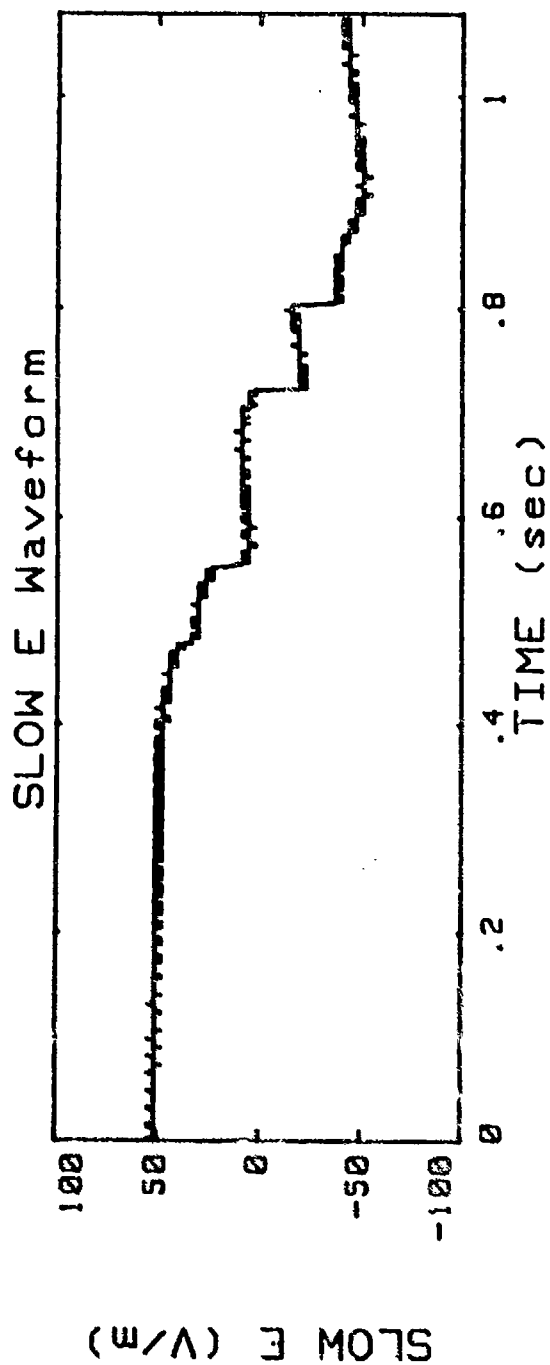


220202012.925 1985

DS Subs RS (29.5 Km)

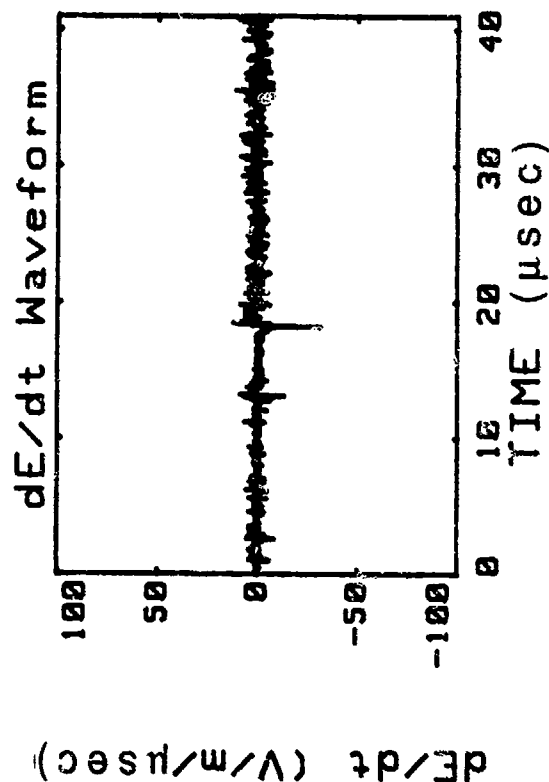
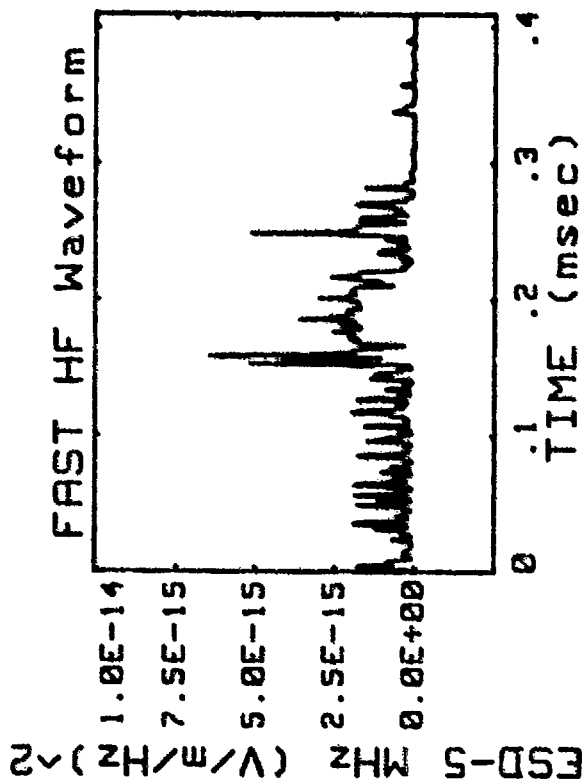
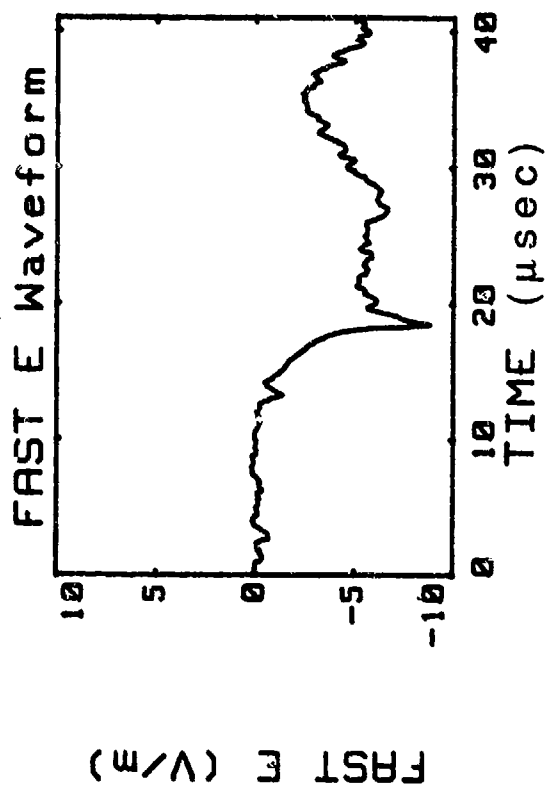
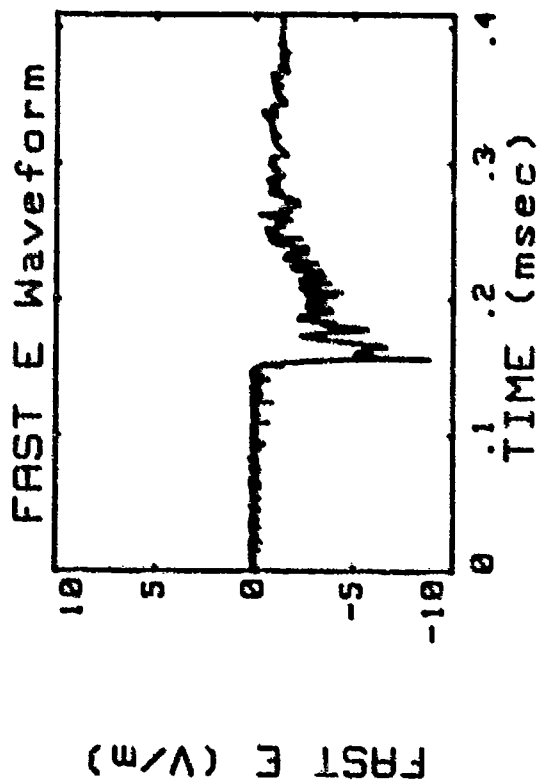


20:20:12.131 8 Aug 1985 (29.5 Km)



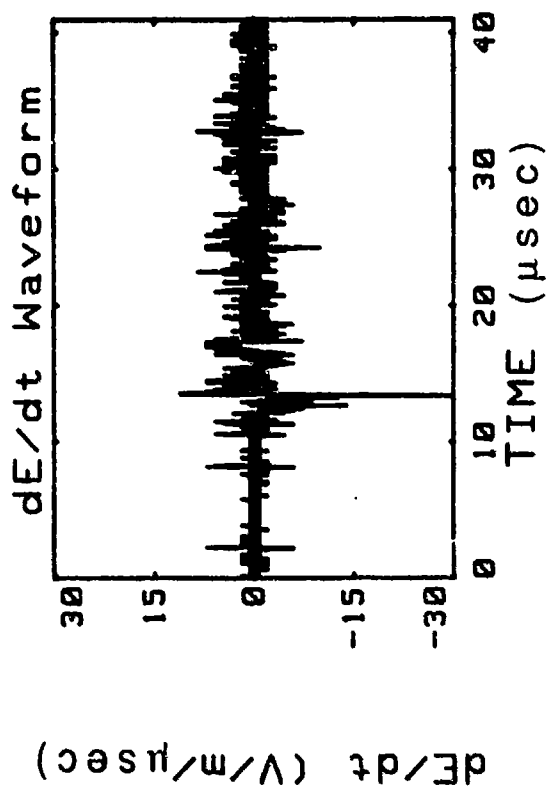
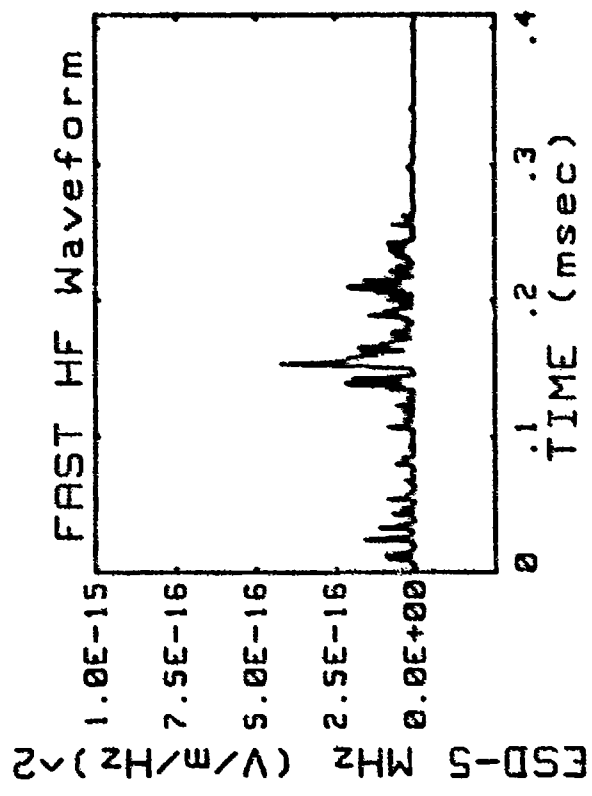
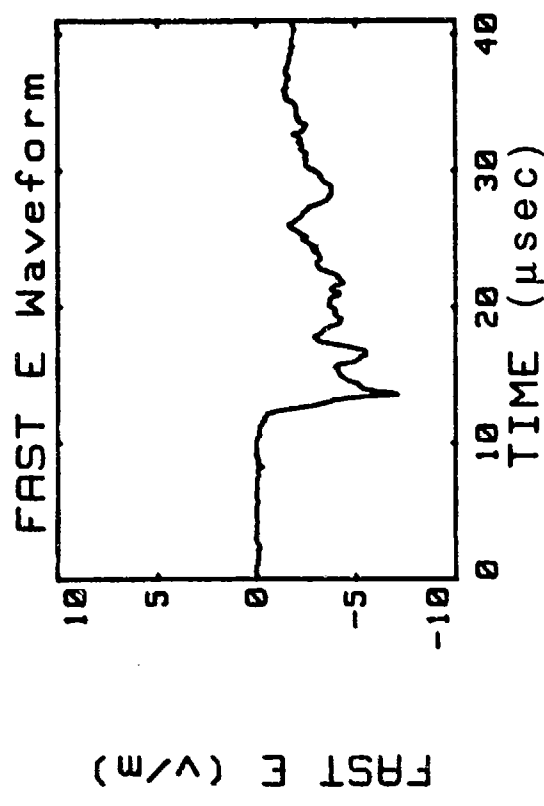
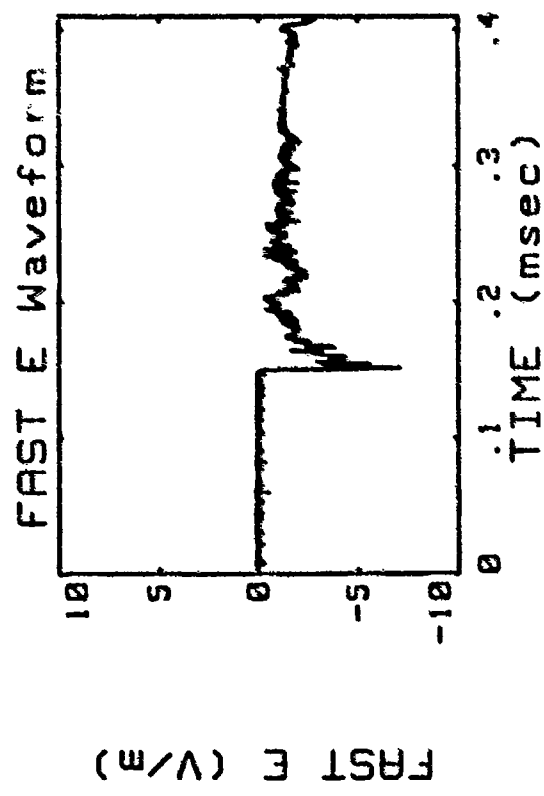
220202032.287 1985

1st RS (29.3 Km)

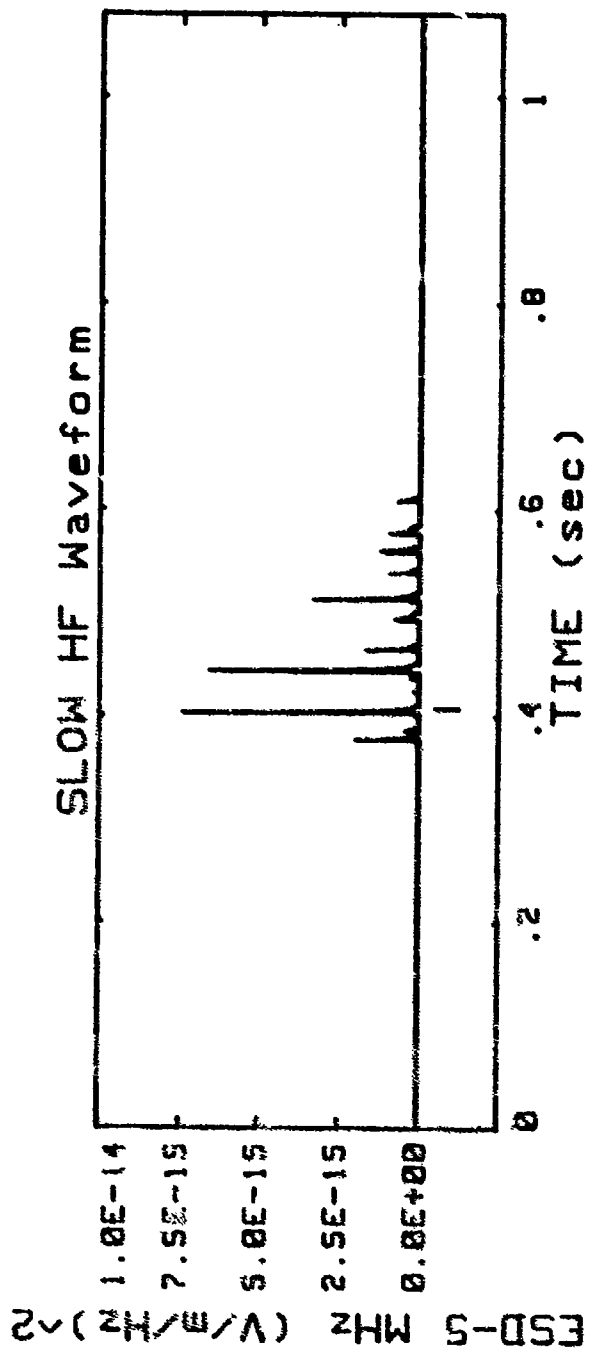
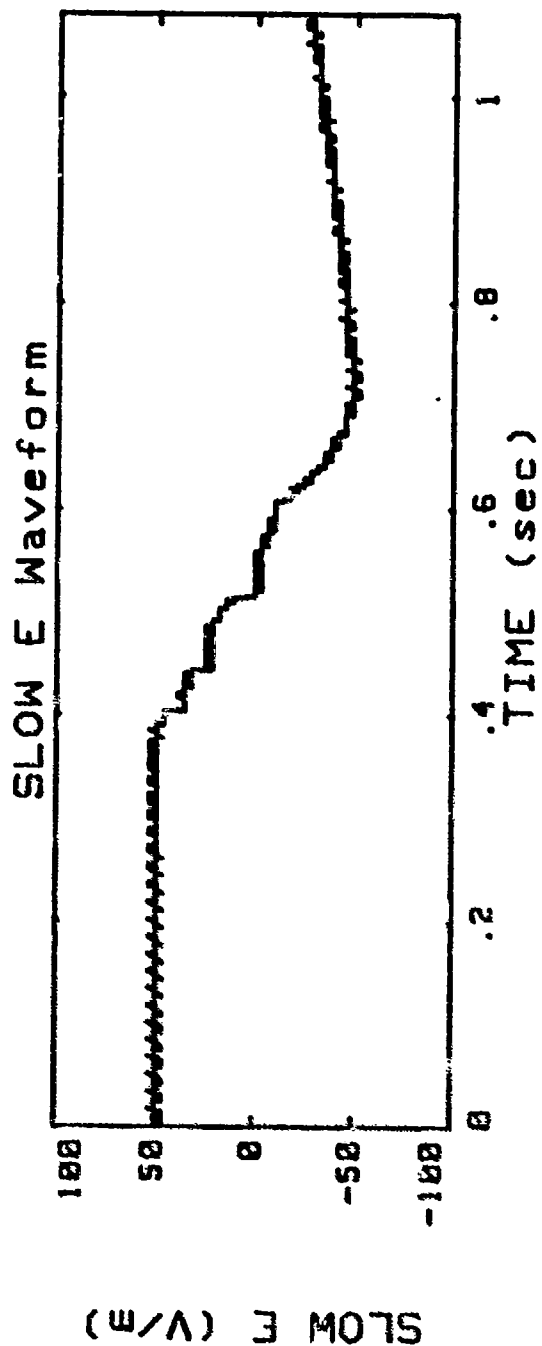


220202219.942 1985

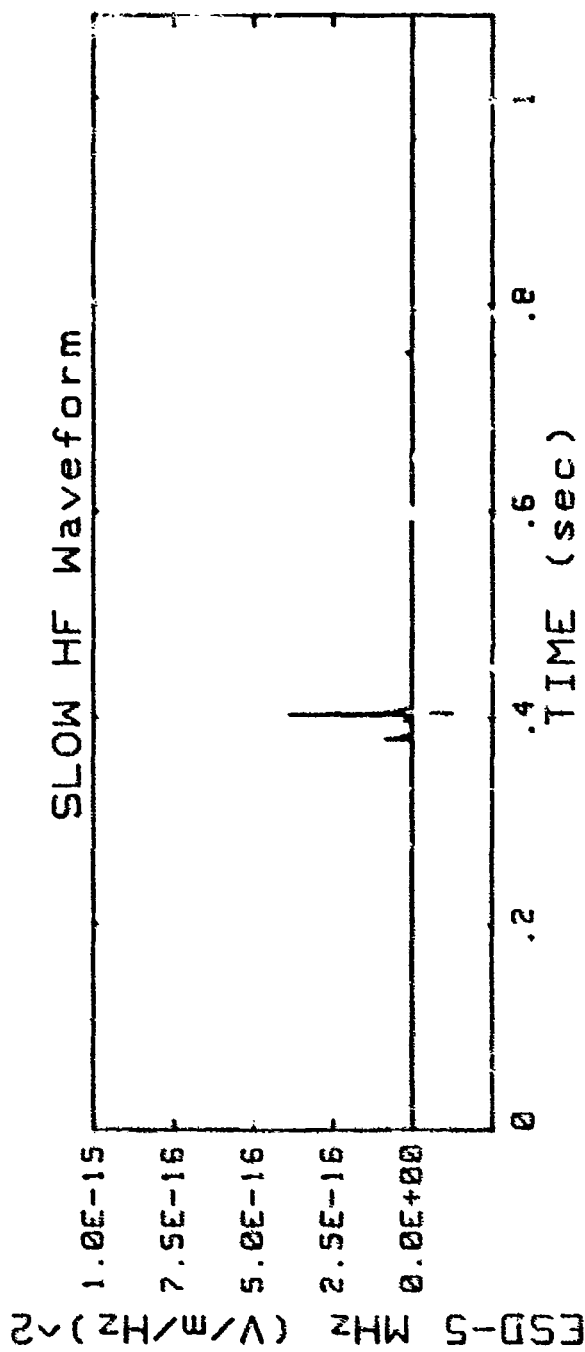
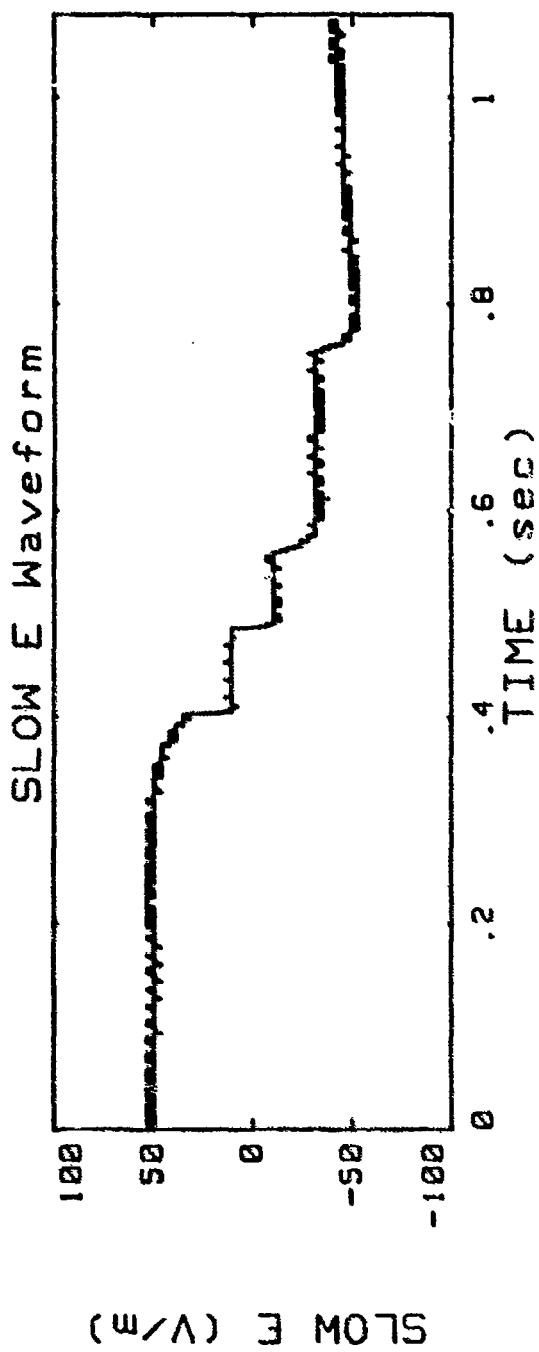
1st RS (32.1 Km)



20:20:31.892 8 Aug 1985 (29.3 Km)

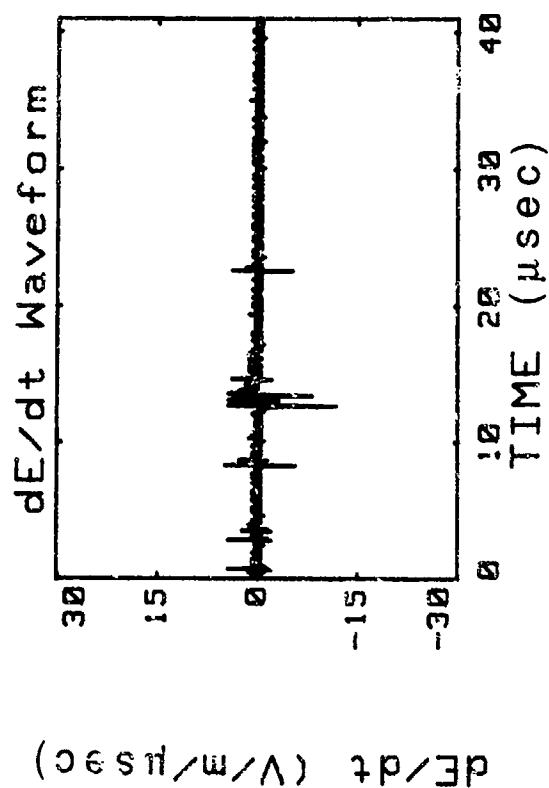
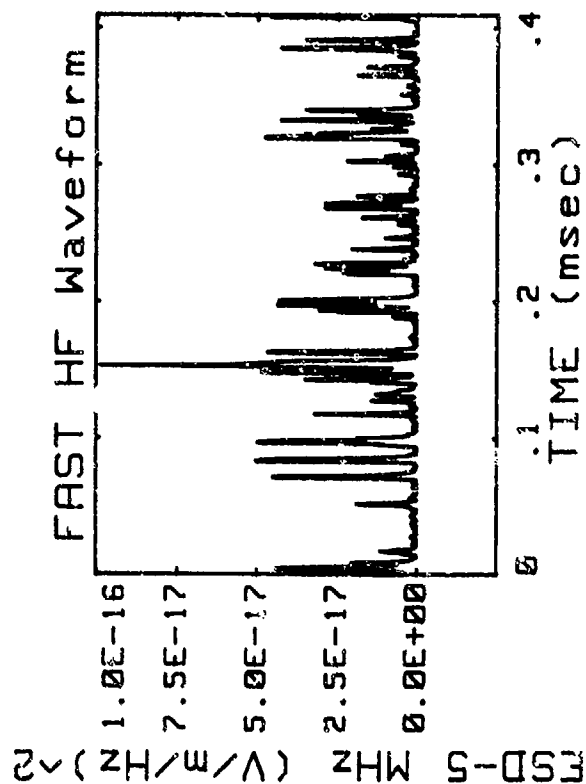
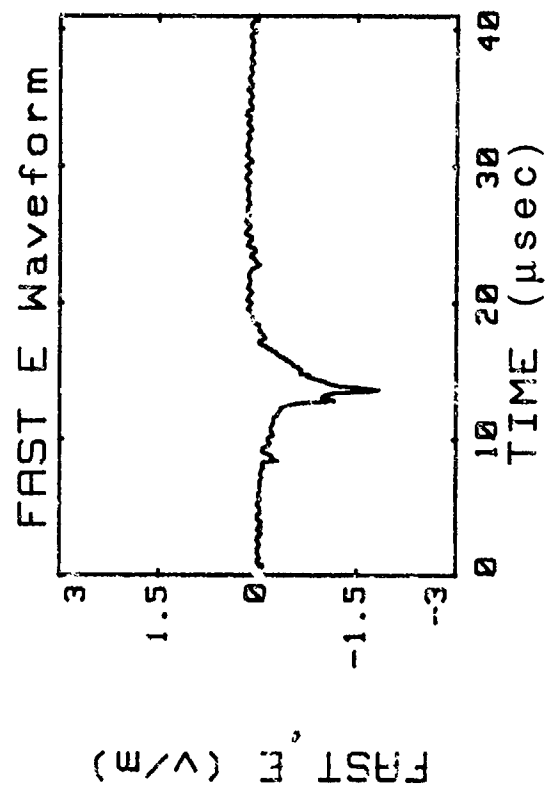
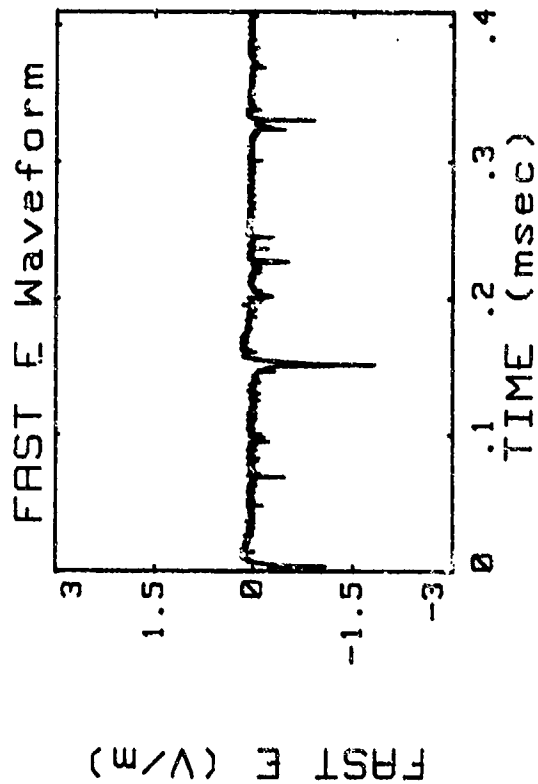


20:22:19.550 8 Aug 1985 (32.1 Km)



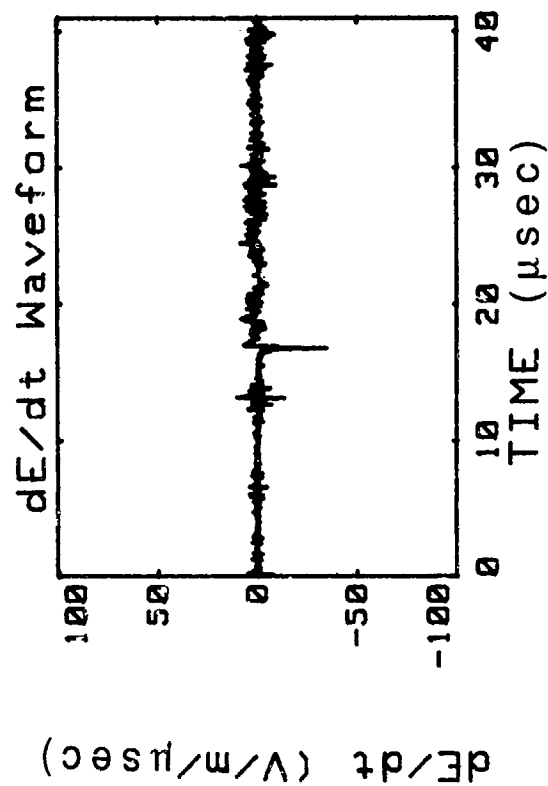
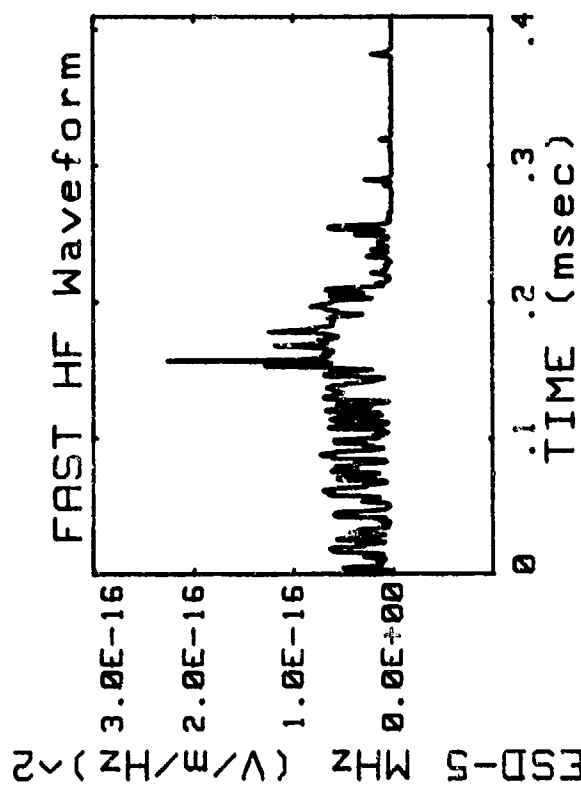
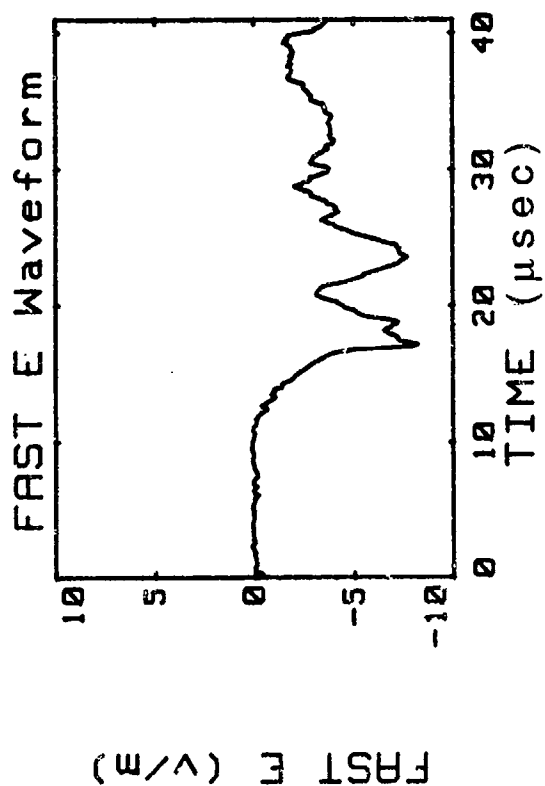
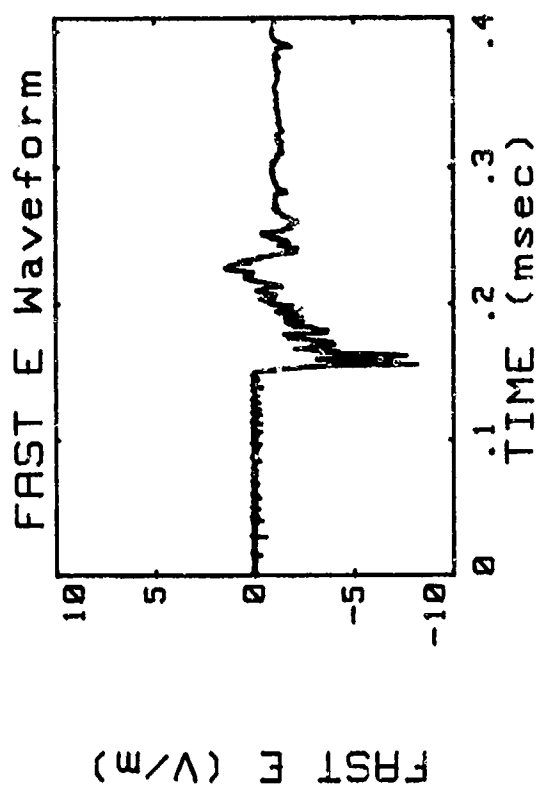
220202529.712 1985

Char Cloud Pulse (30 Km)

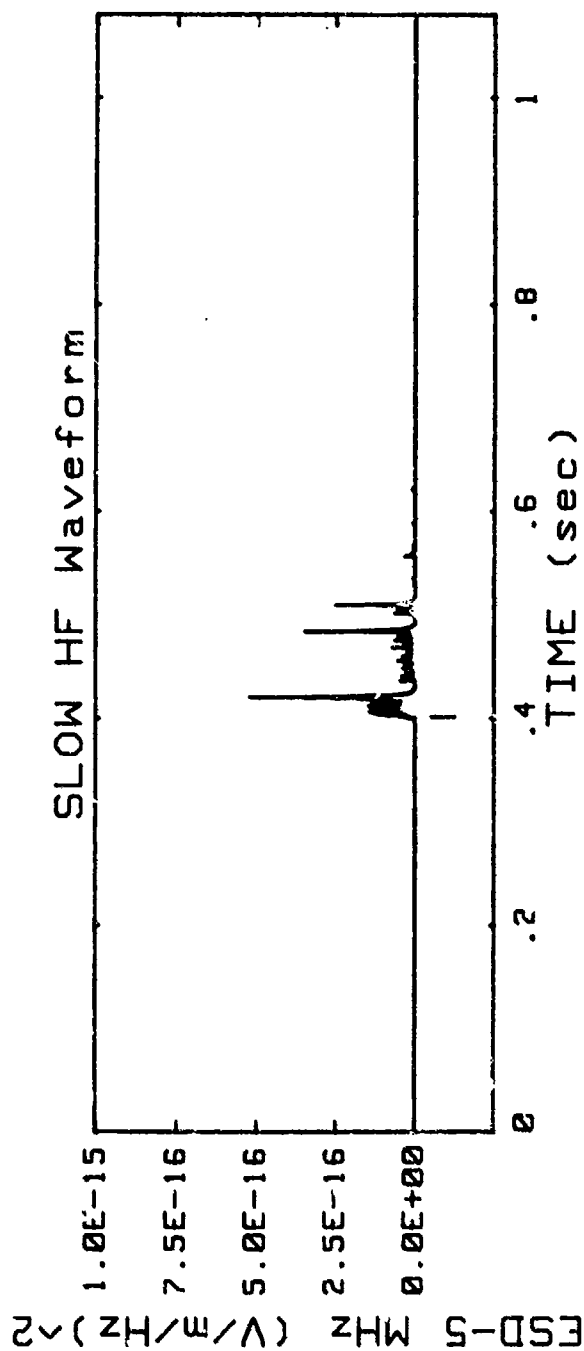
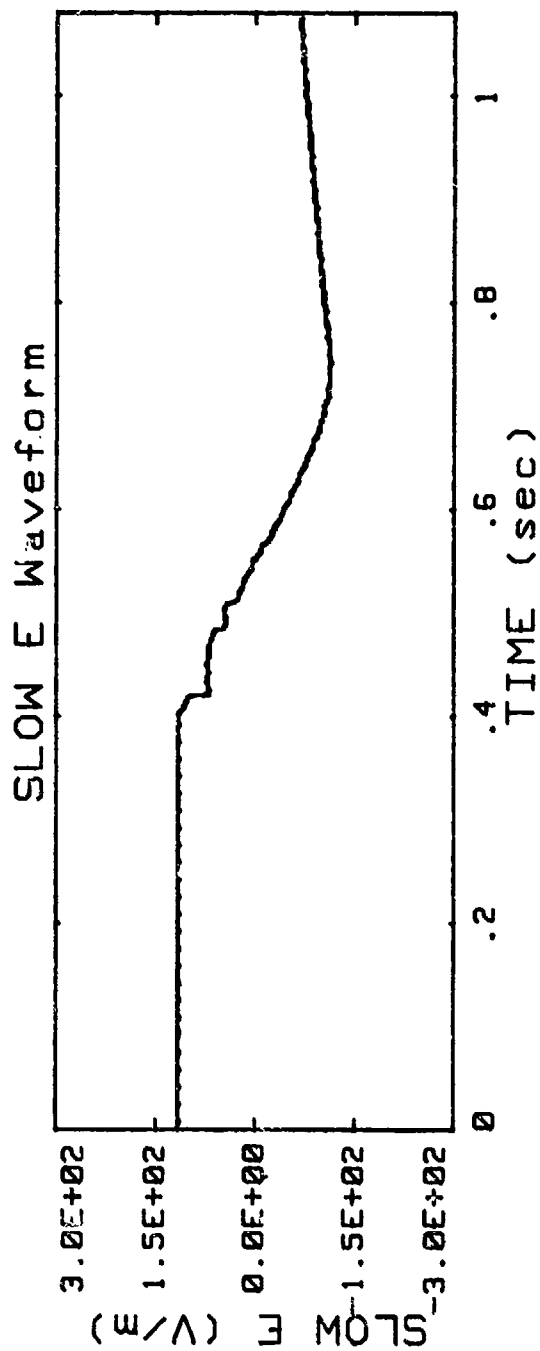


220202622.439 1985

1st RS (34.1 Km)

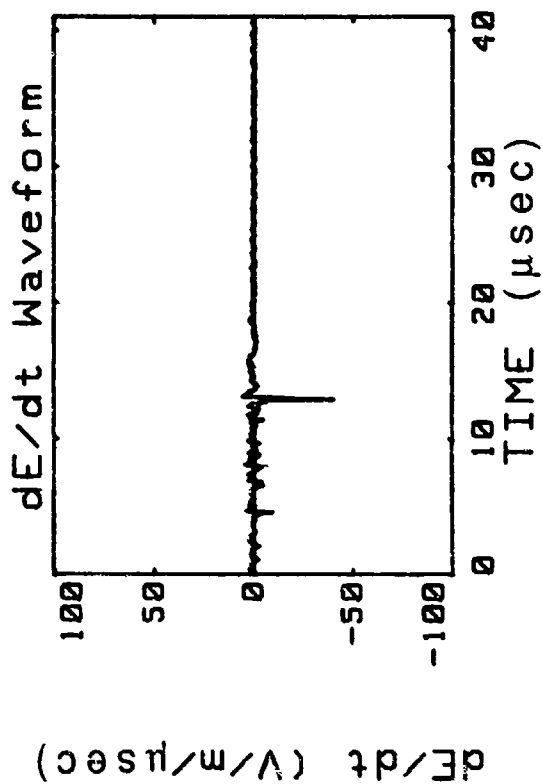
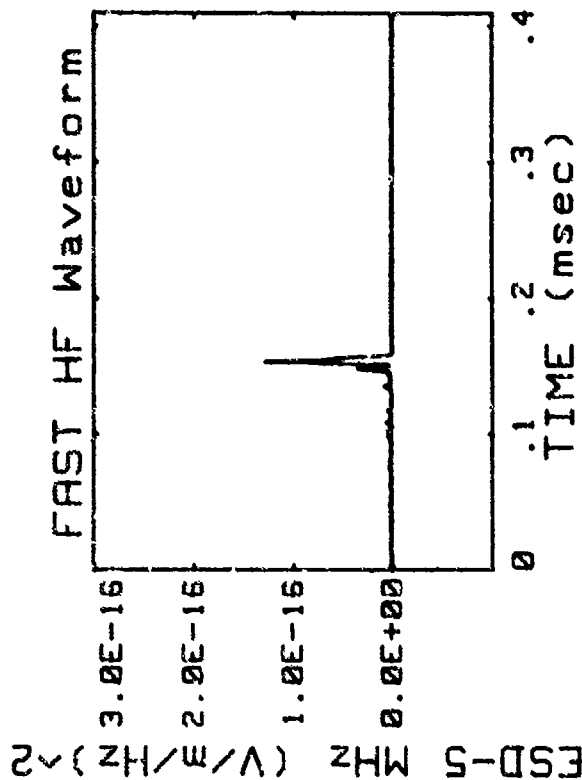
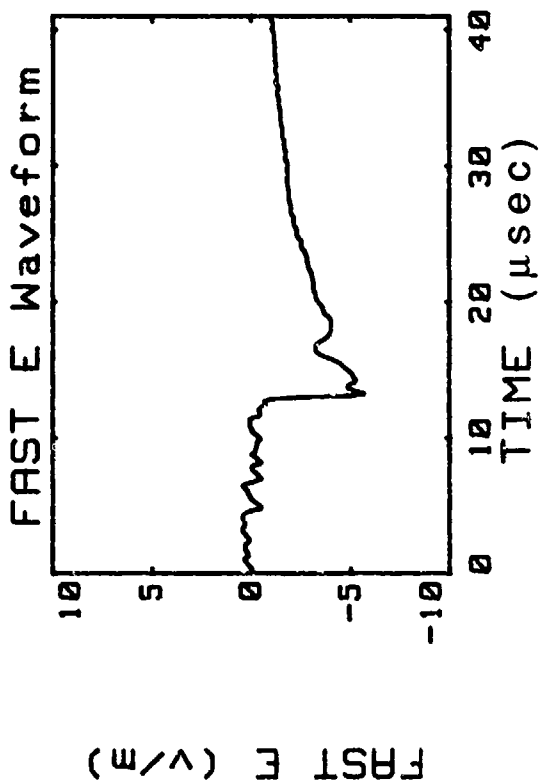
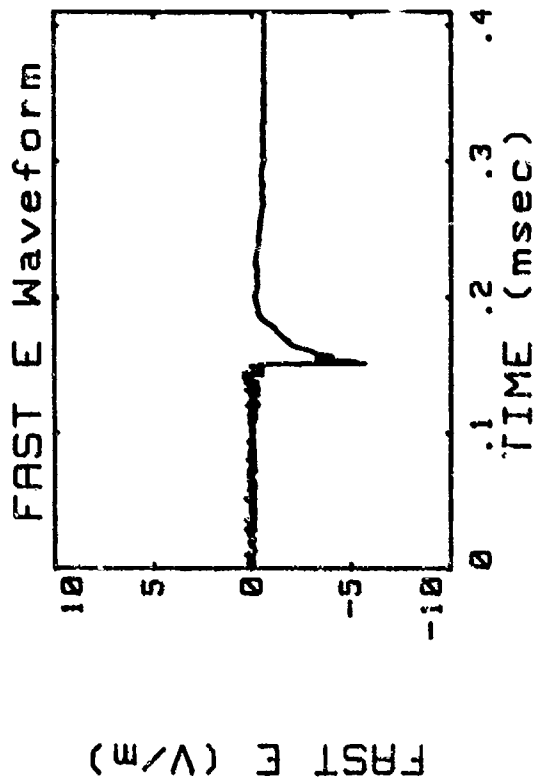


20:25:29.323 8 Aug 1985 (30 Km)

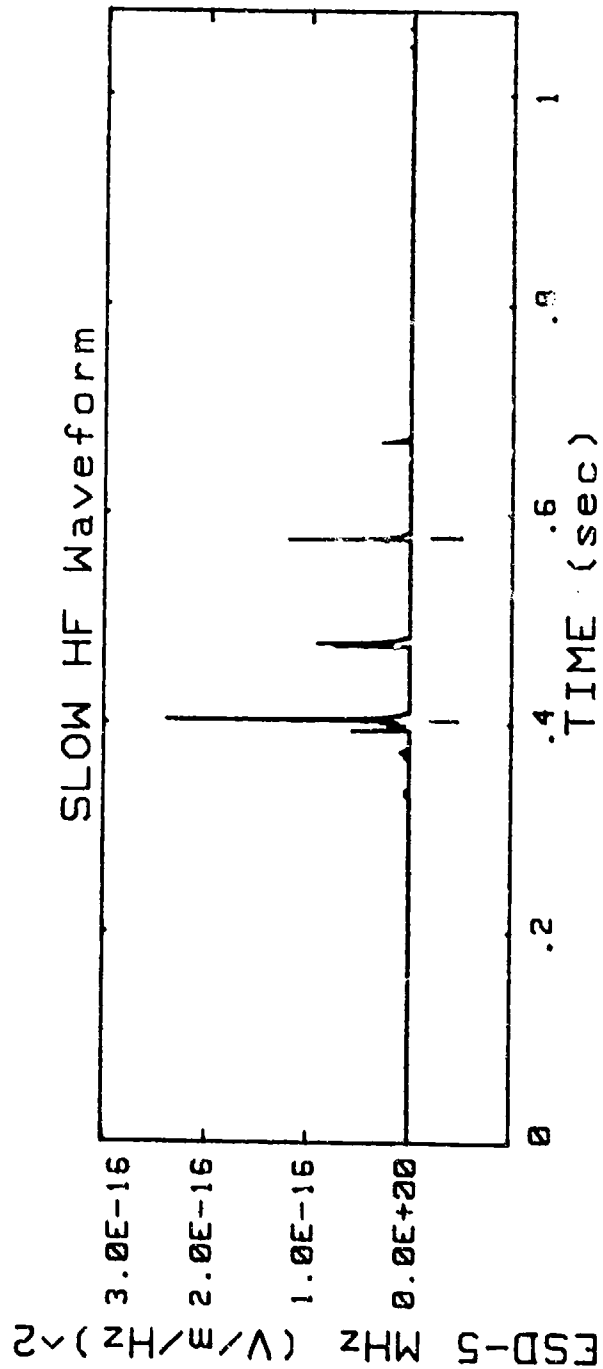
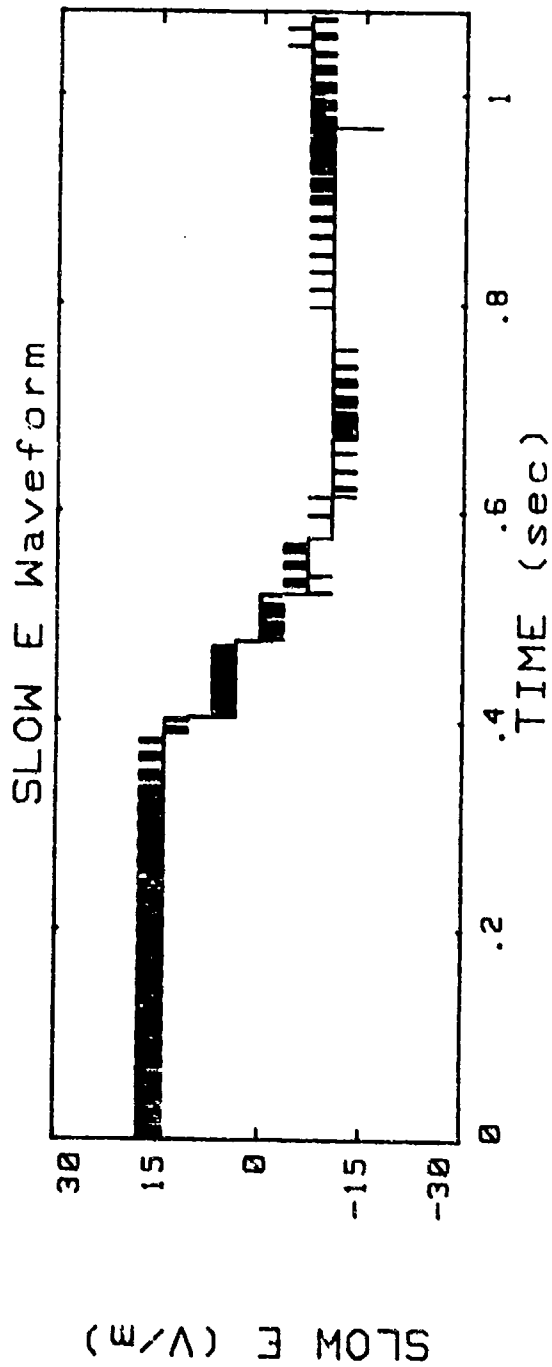


220202622.611 1985

Chaotic Subs RS (34.1 Km)

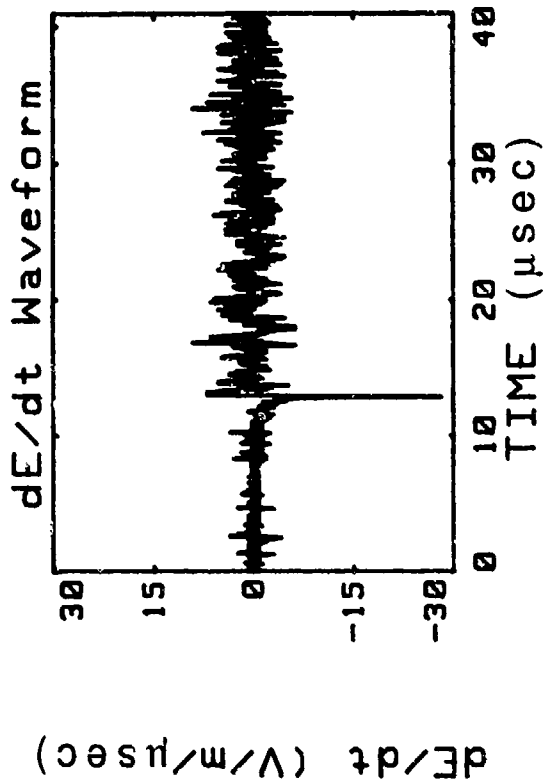
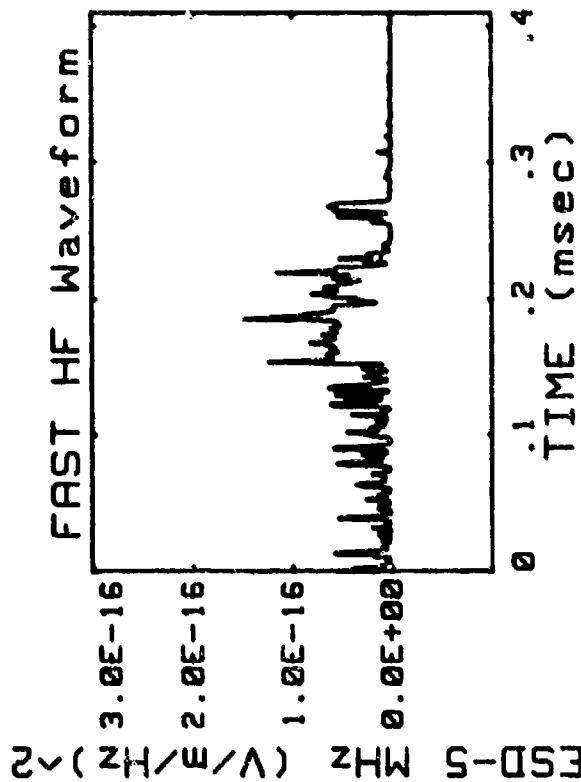
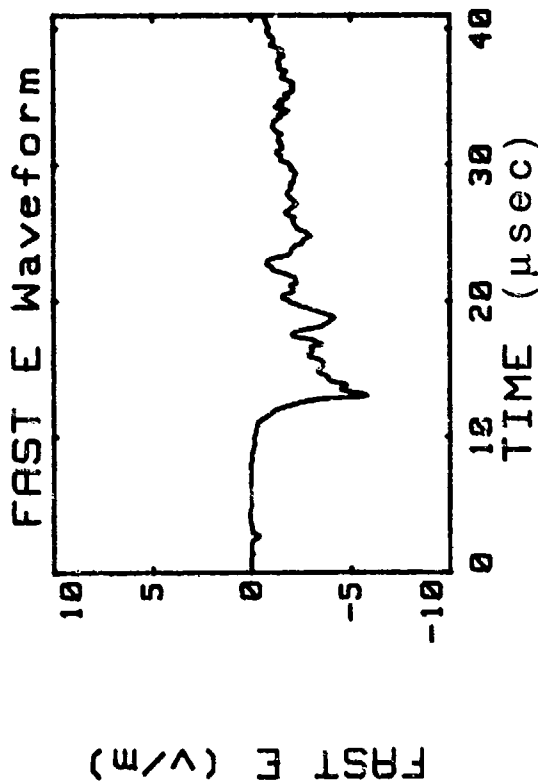
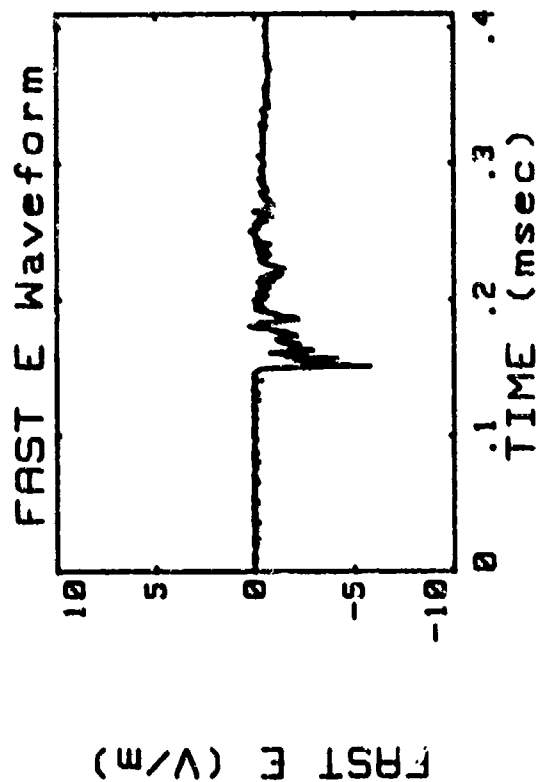


20:26:22.046 8 Aug 1985 (34.1 Km)

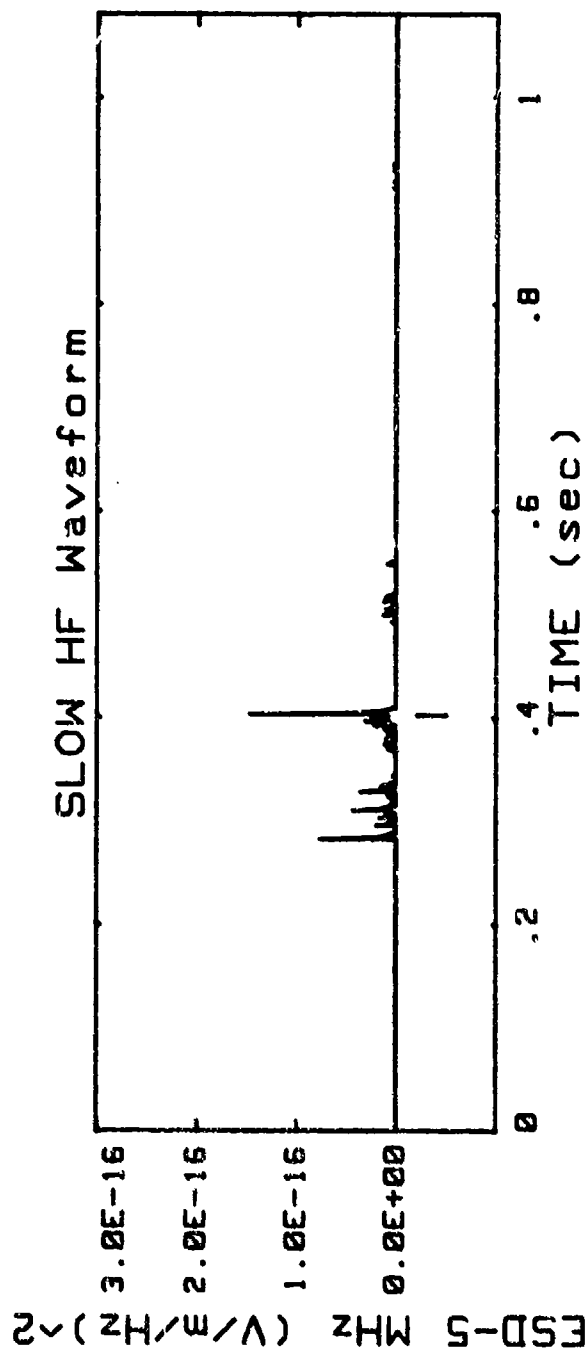
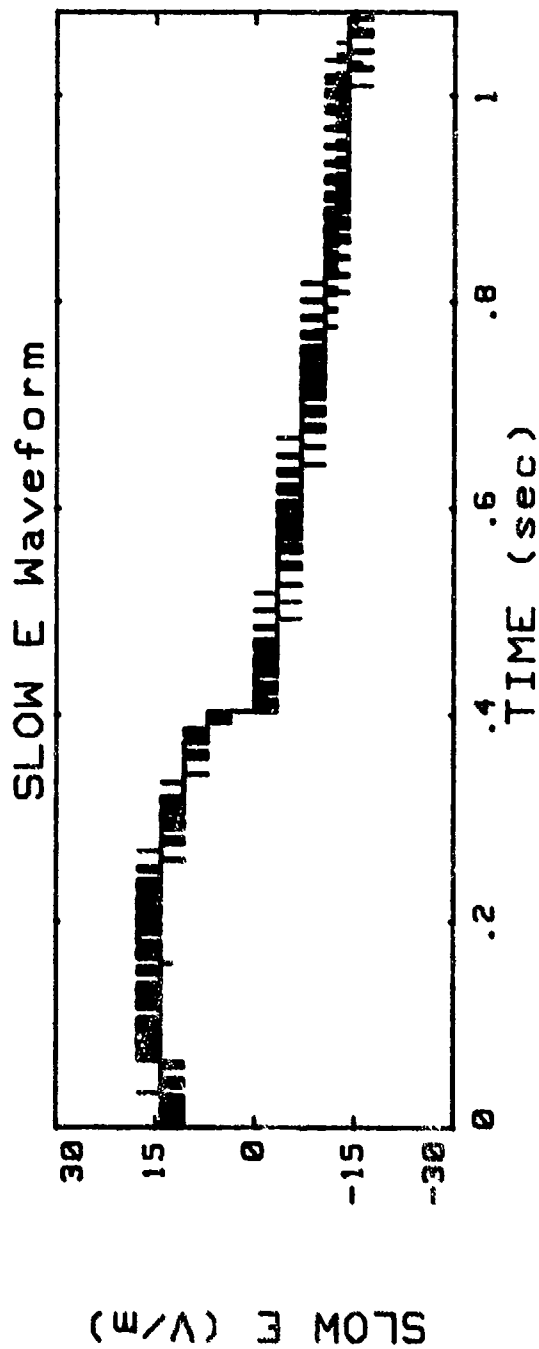


220202710.726 1985

1st RS (32.9 Km)

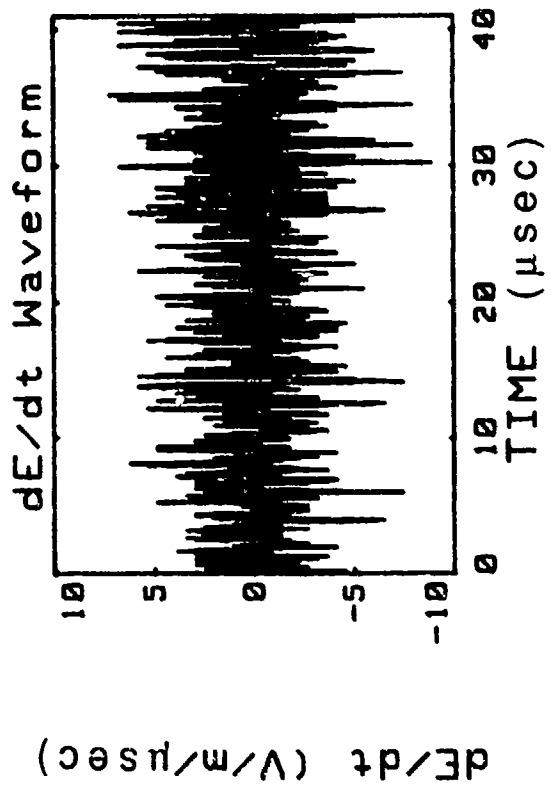
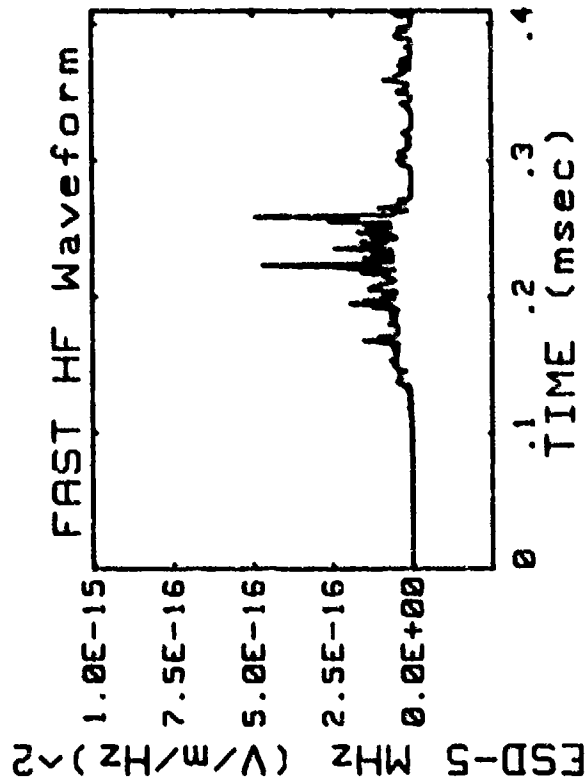
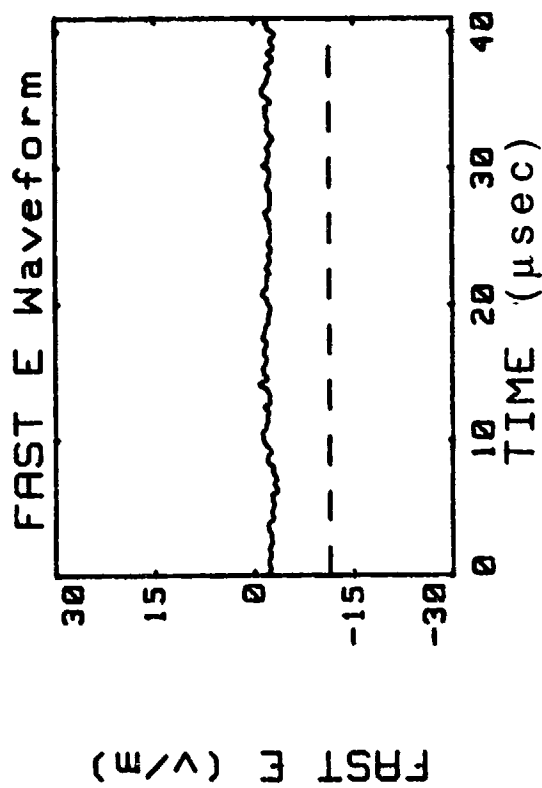
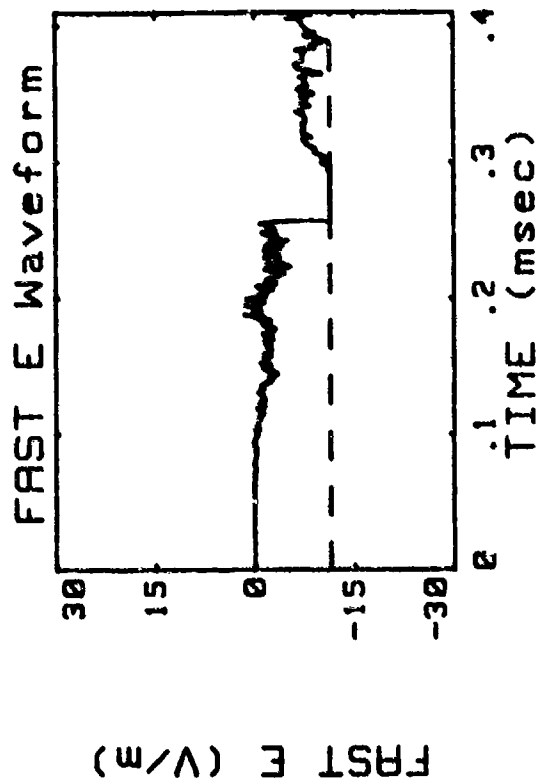


20:27:10.336 8 Aug 1985 (32.9 Km)

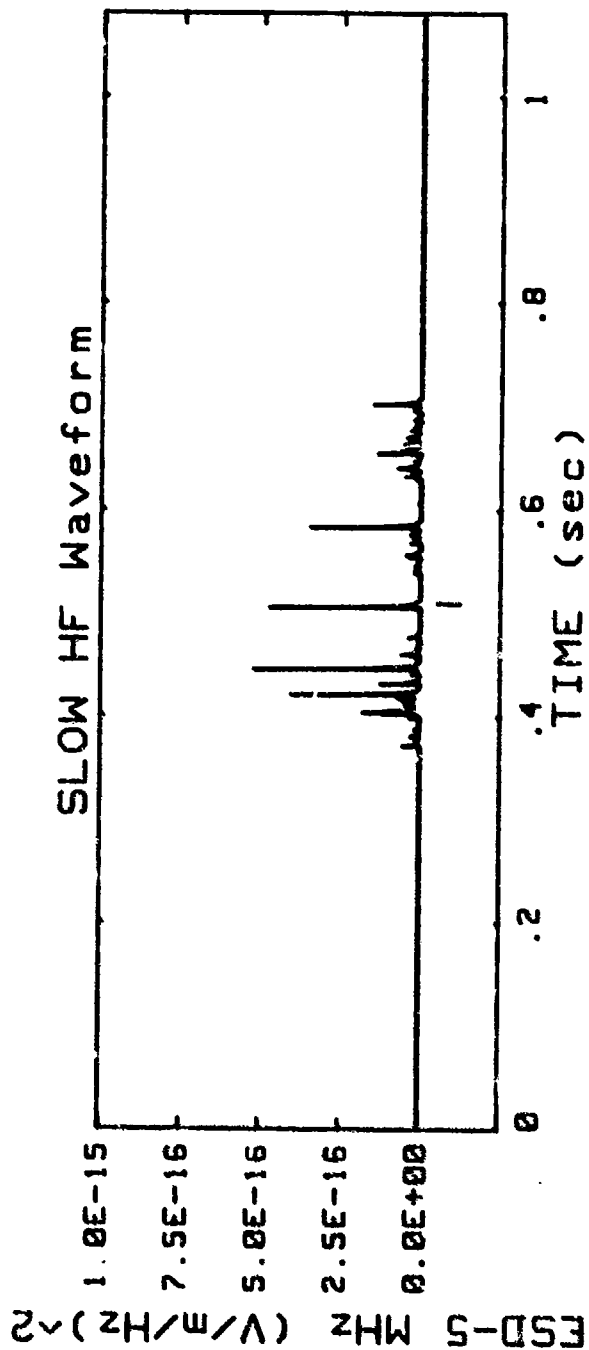
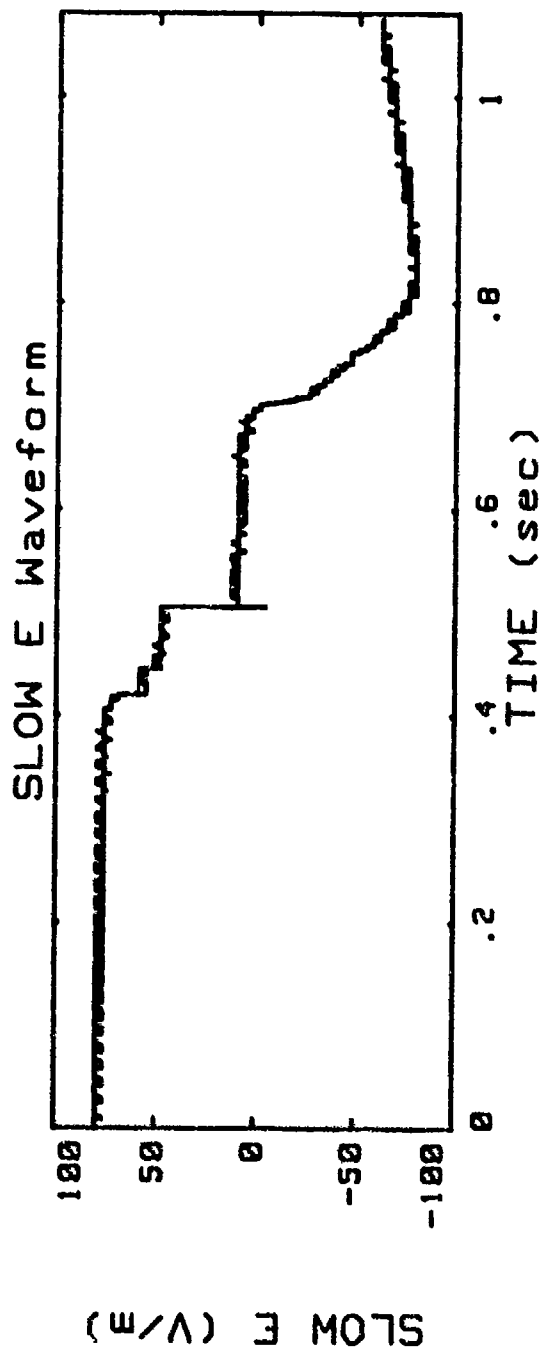


220202758.185 1985

Chaotic Leader (27.9 Km)

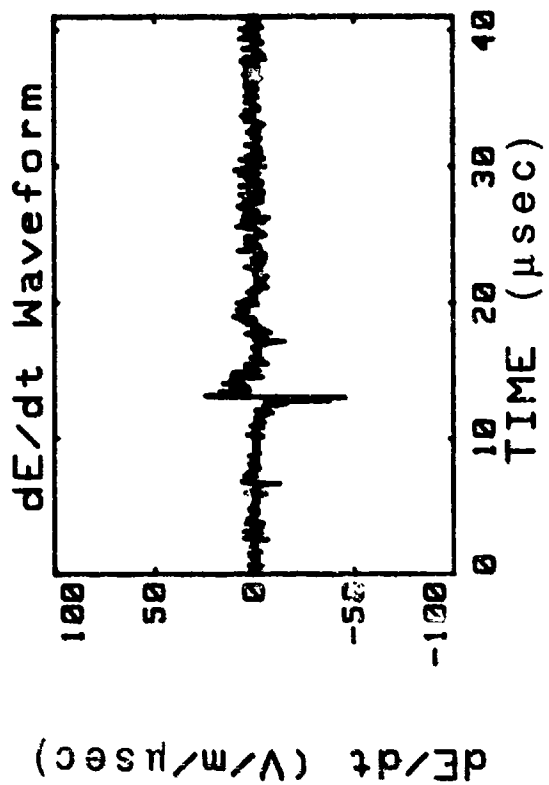
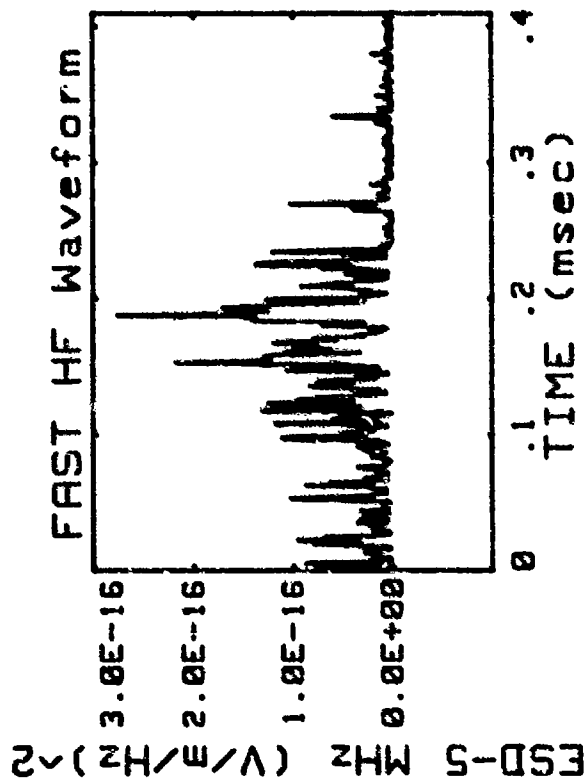
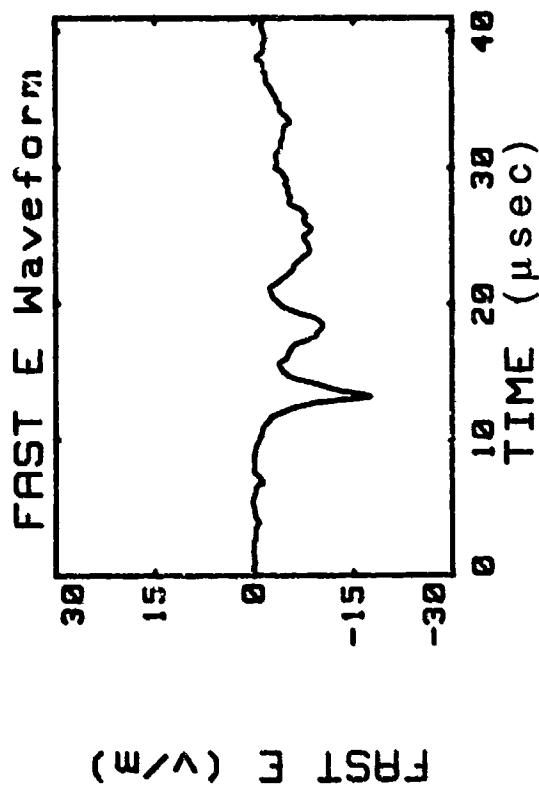
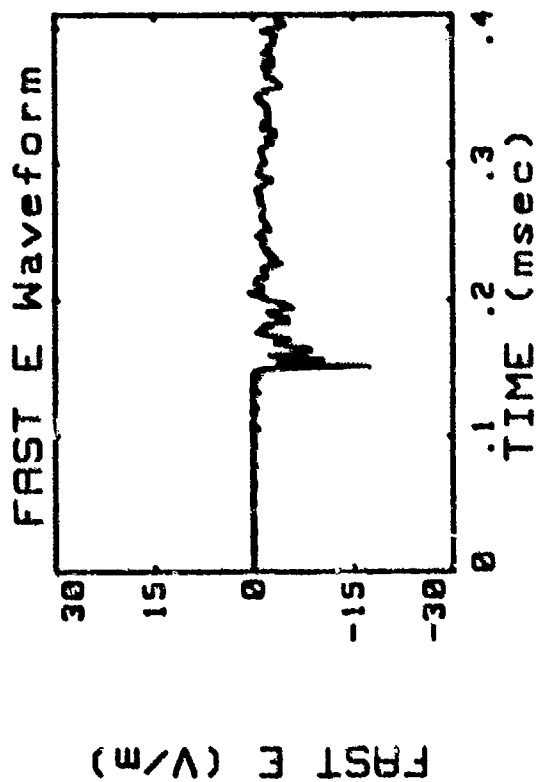


20:27:57.688 8 Aug 1985 (27.9 Km)

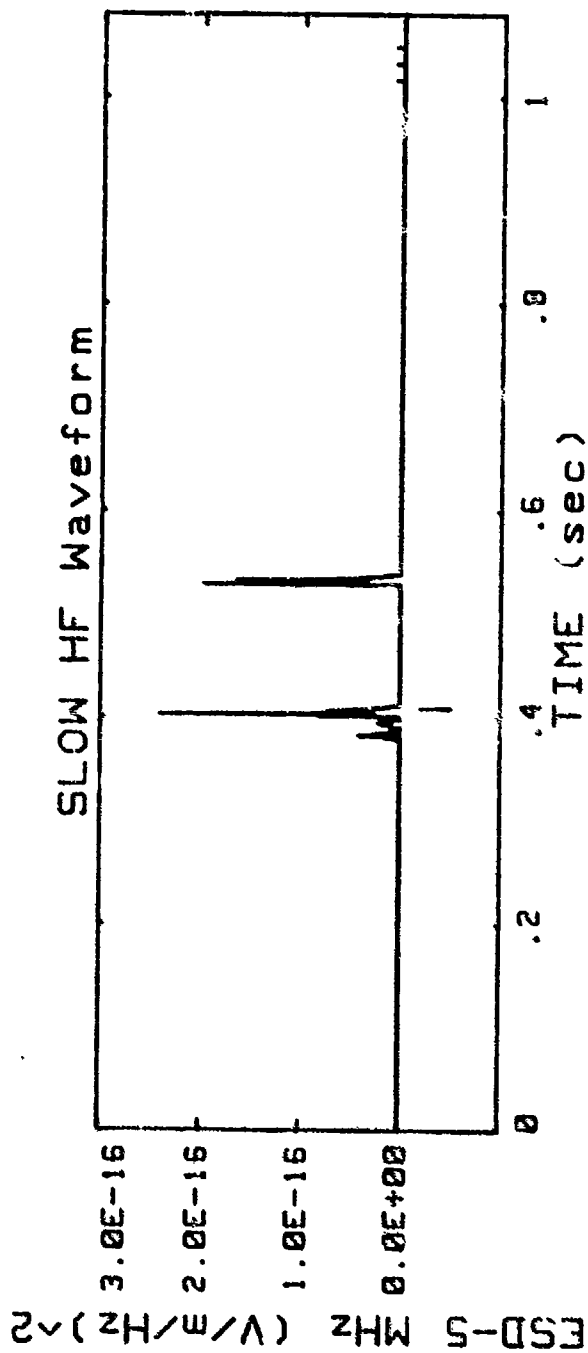
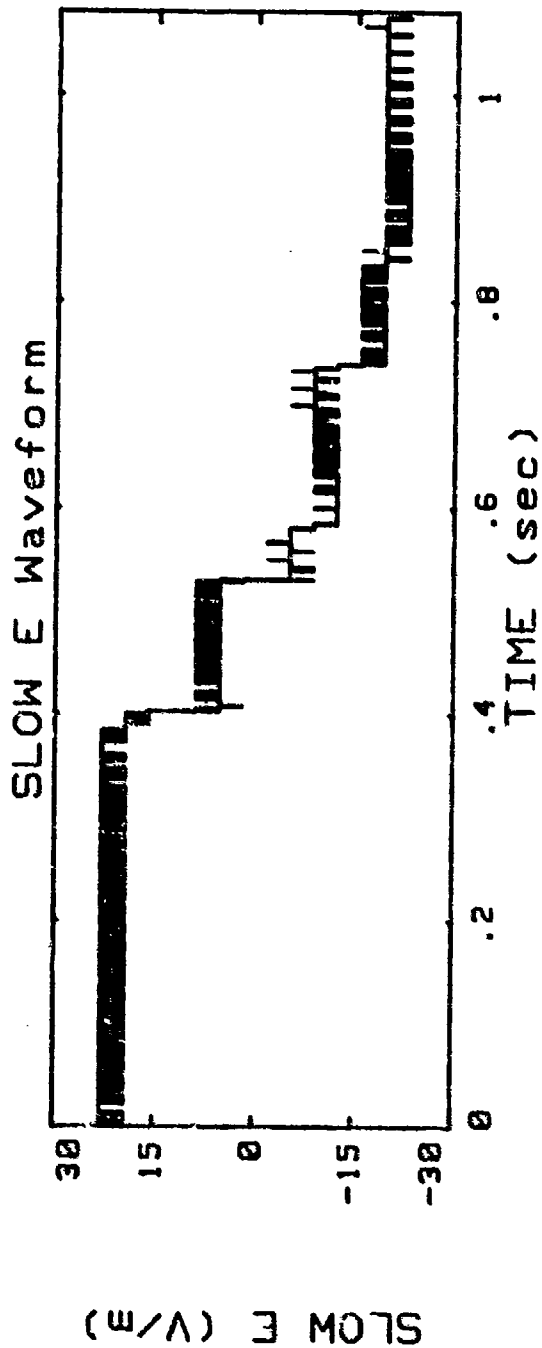


220202018.614 1985

1st RS (49.6 Km)

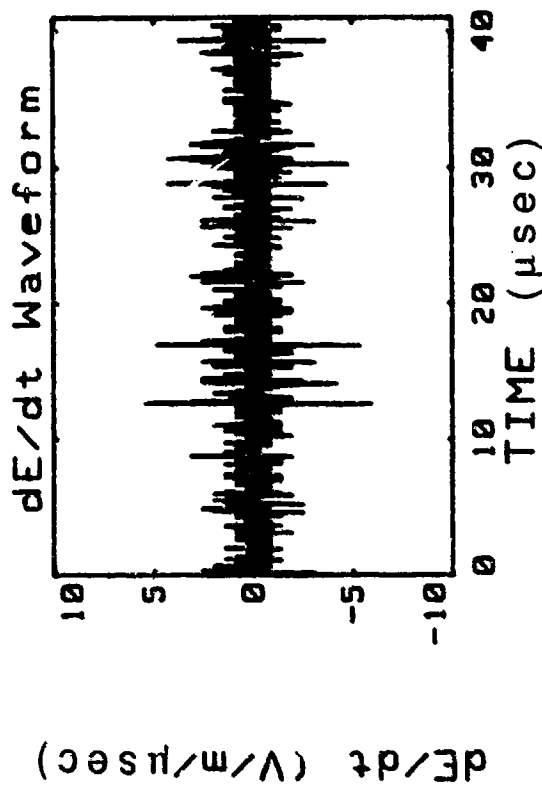
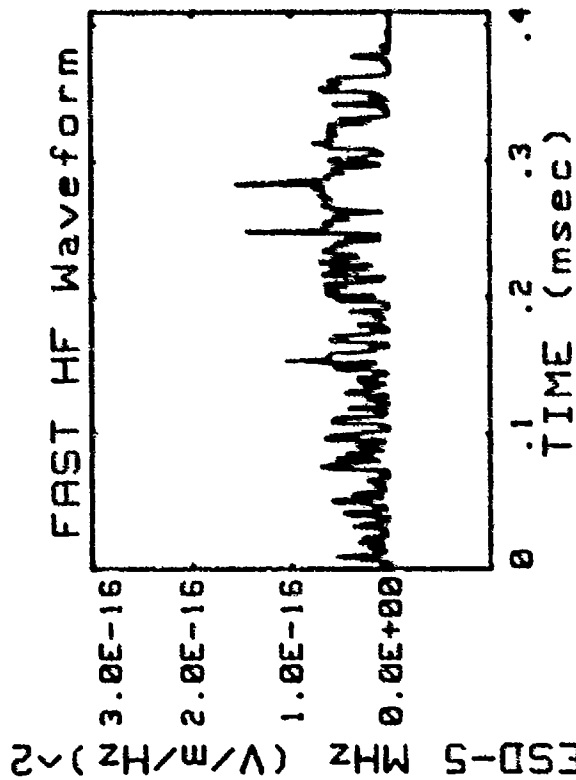
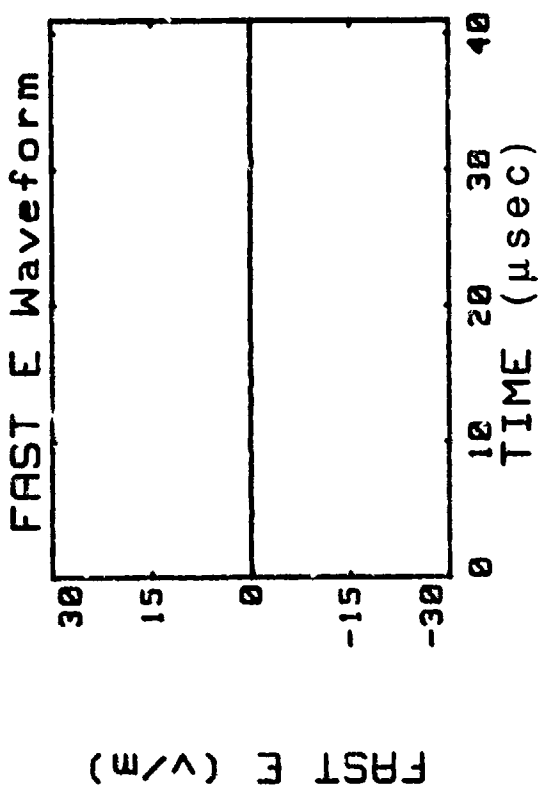
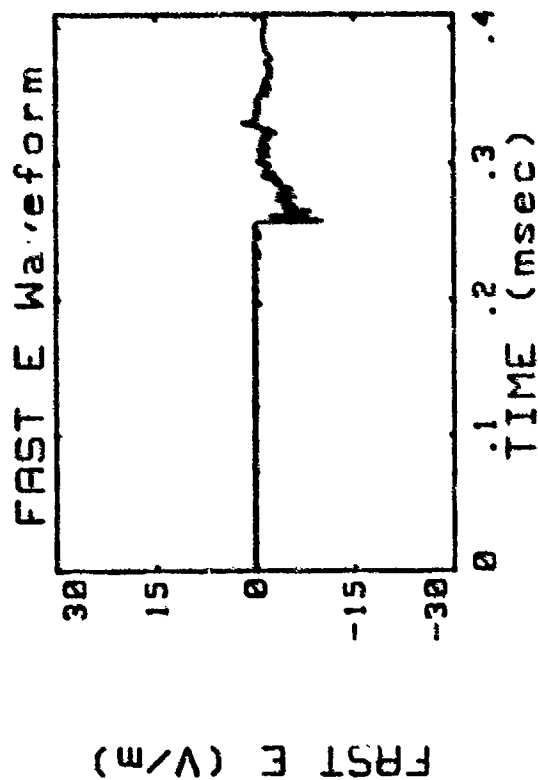


20:28:18.217 8 Aug 1985 (49.6 Km)

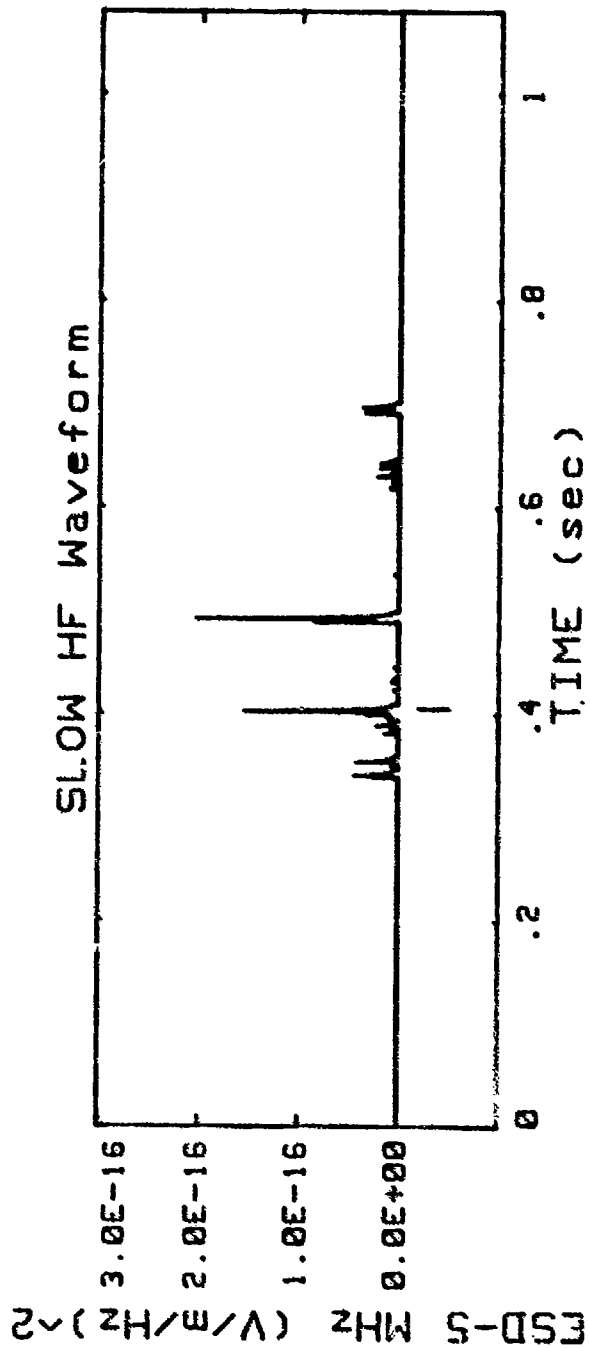
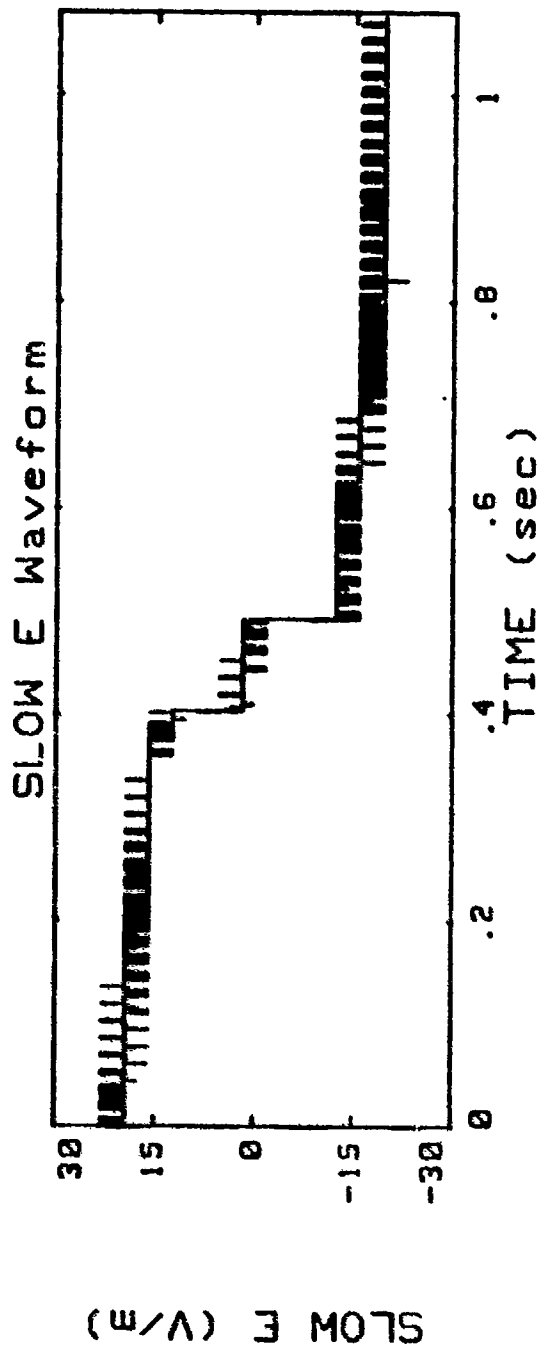


220202036.123 1985

Stepped Leader (33.5 Km)

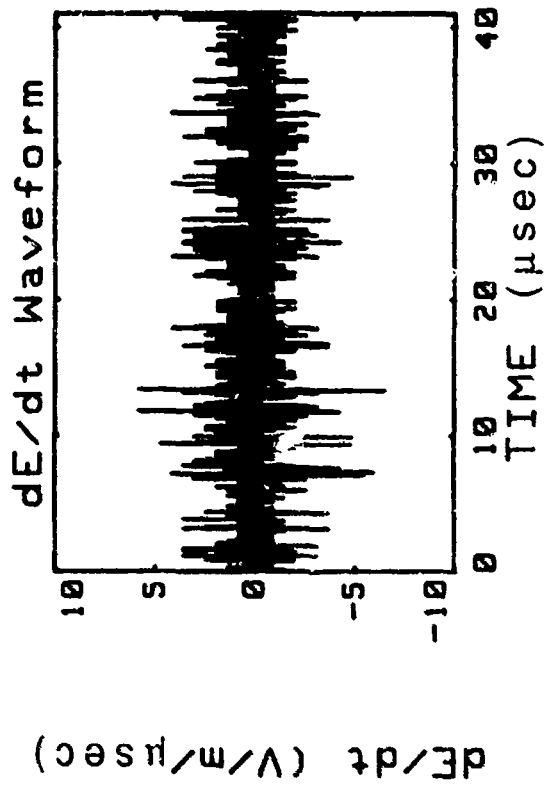
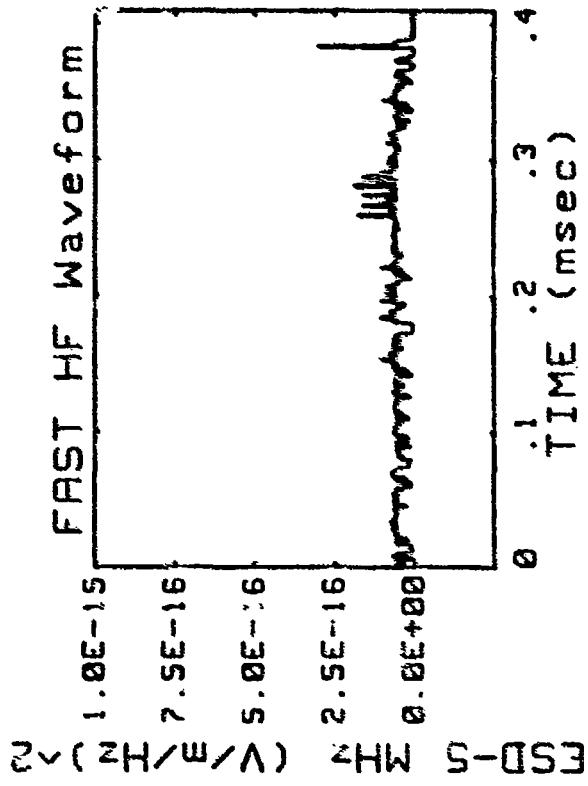
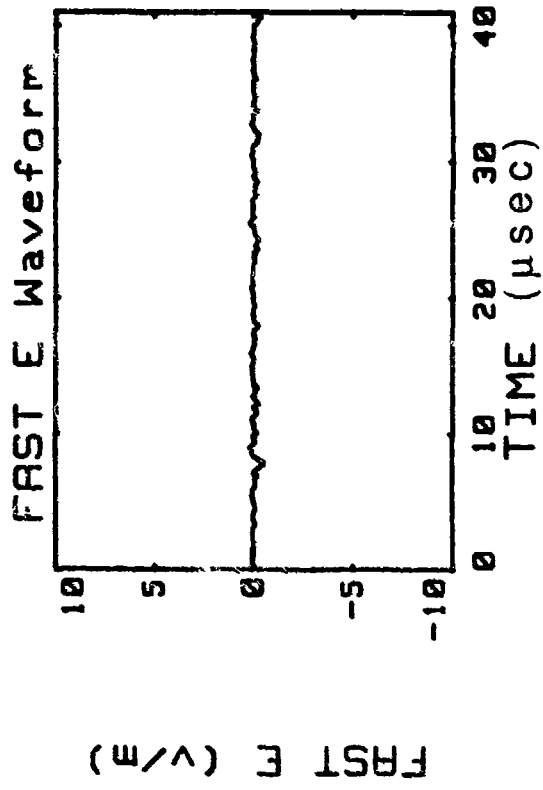
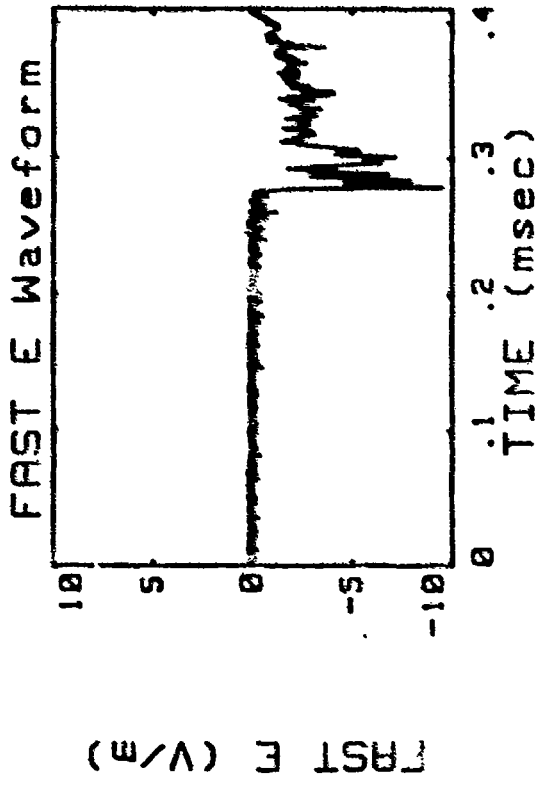


20:28:35.730 8 Aug 1985 (33.5 Km)



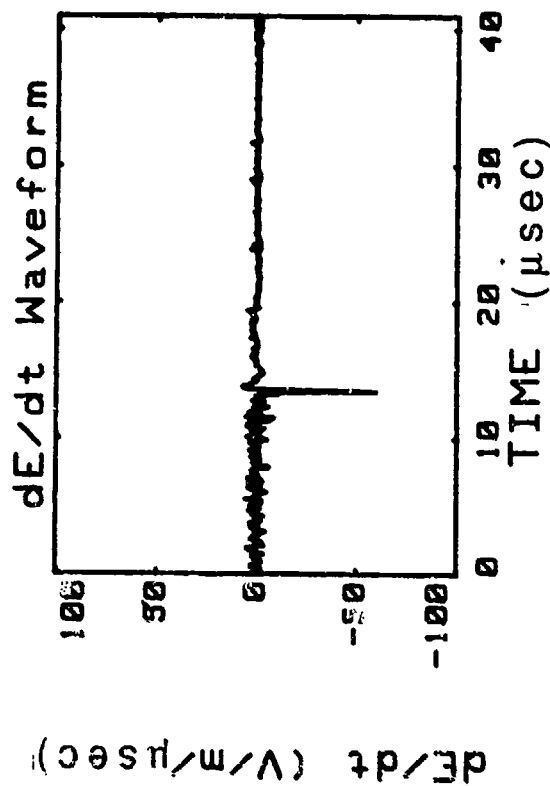
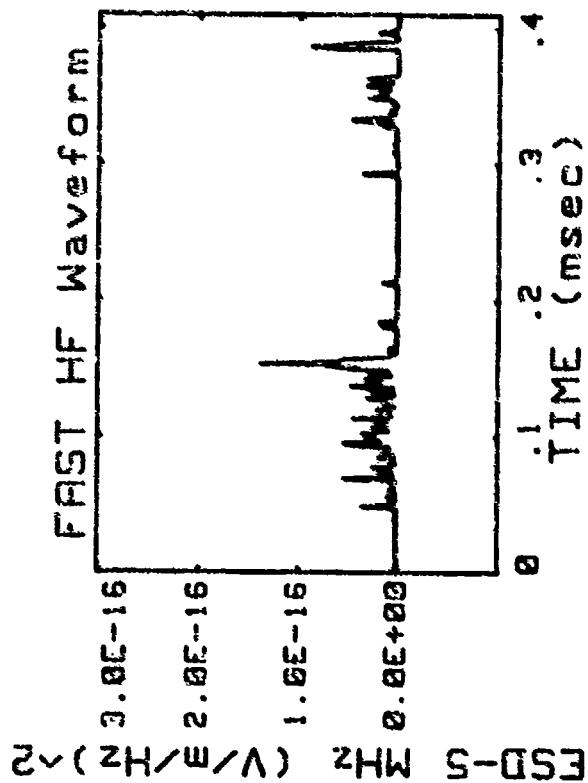
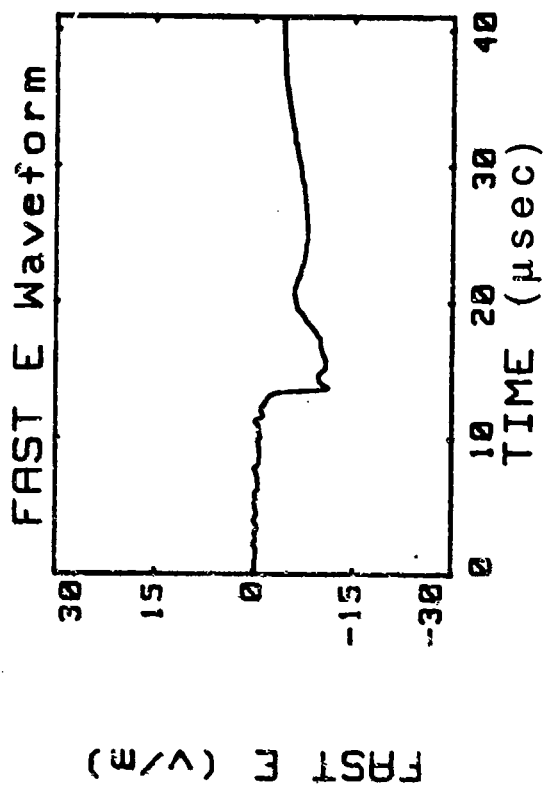
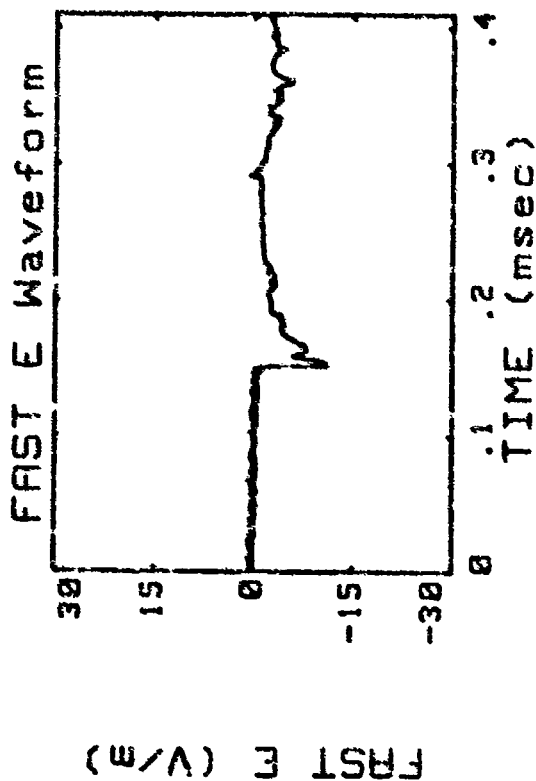
220202923.667 1985

Stepped Leader (33.2 Km)

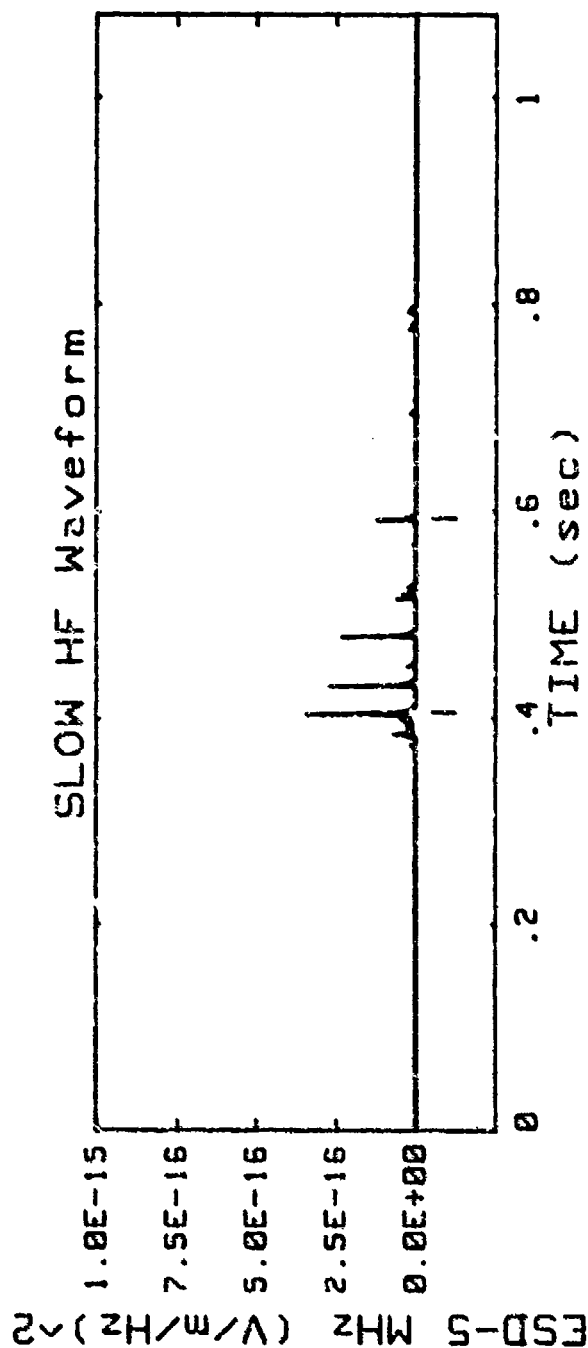
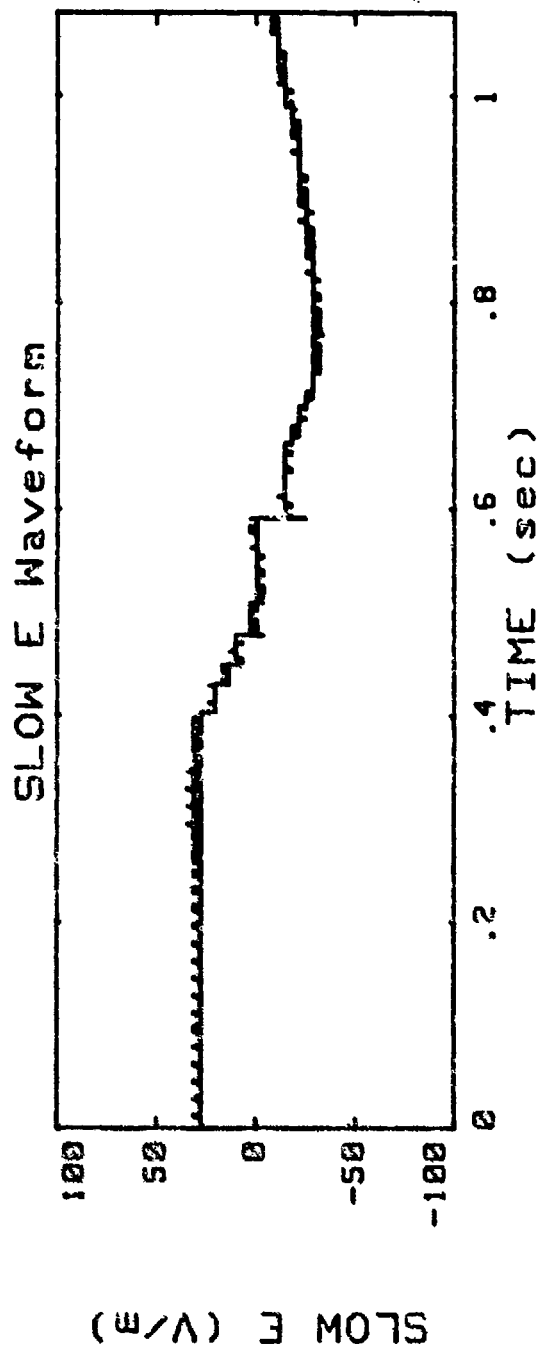


220202923.055 1985

Chaotic Subs RS (33.2 Km)

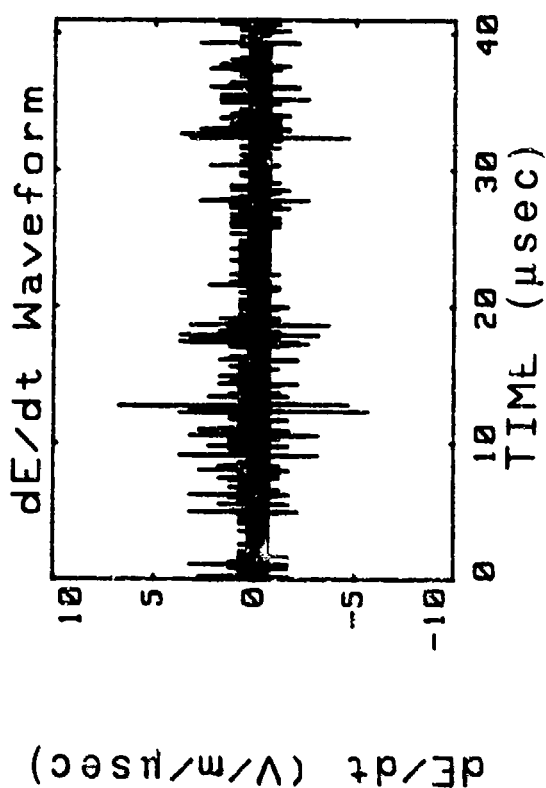
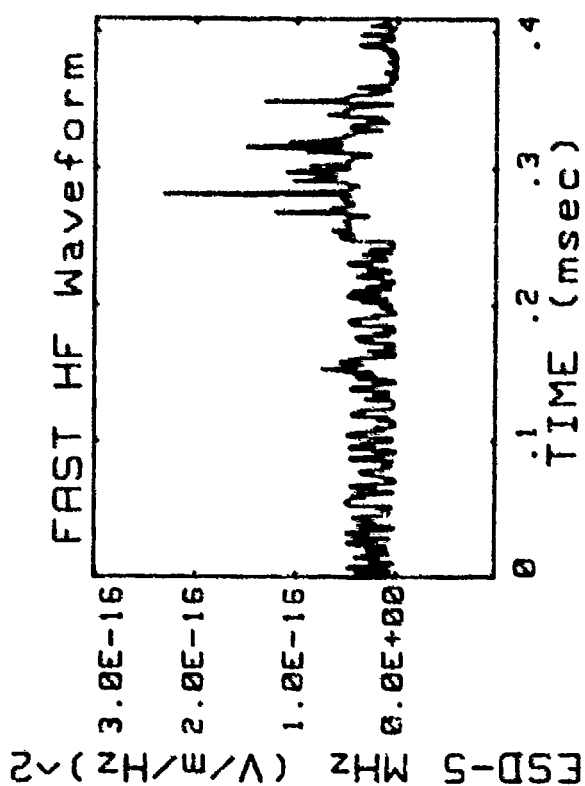
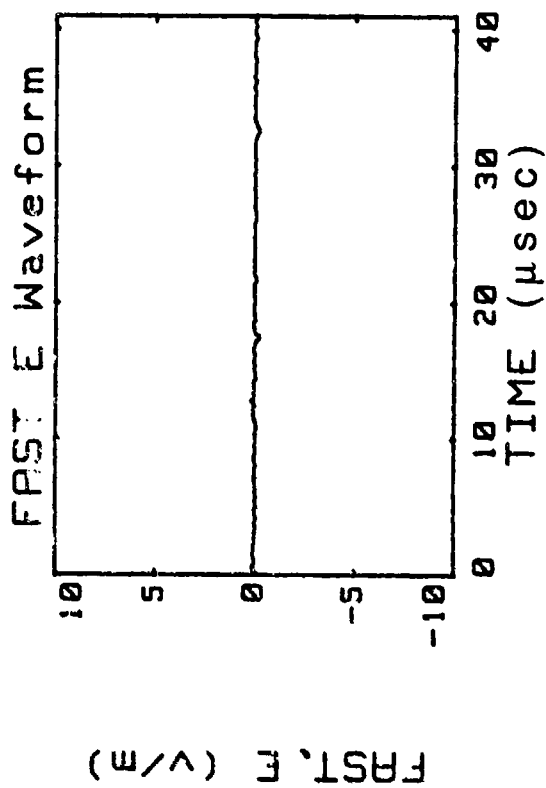
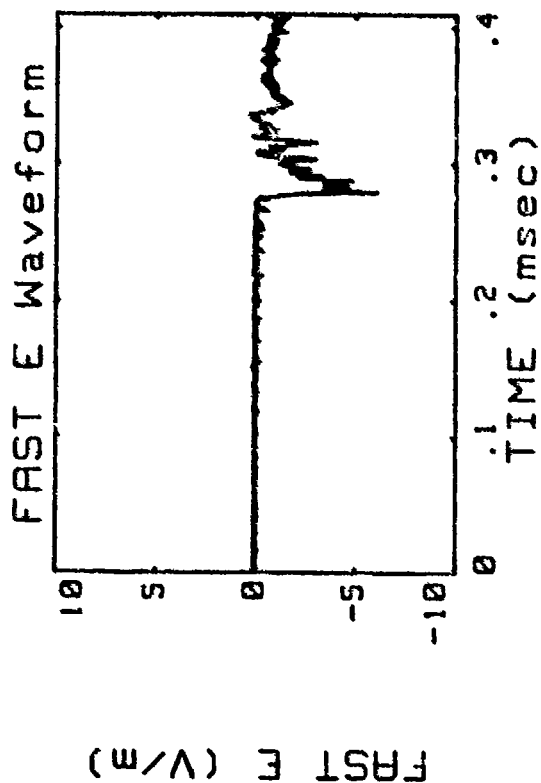


20:29:23.274 8 Aug 1985 (33.2 Km)

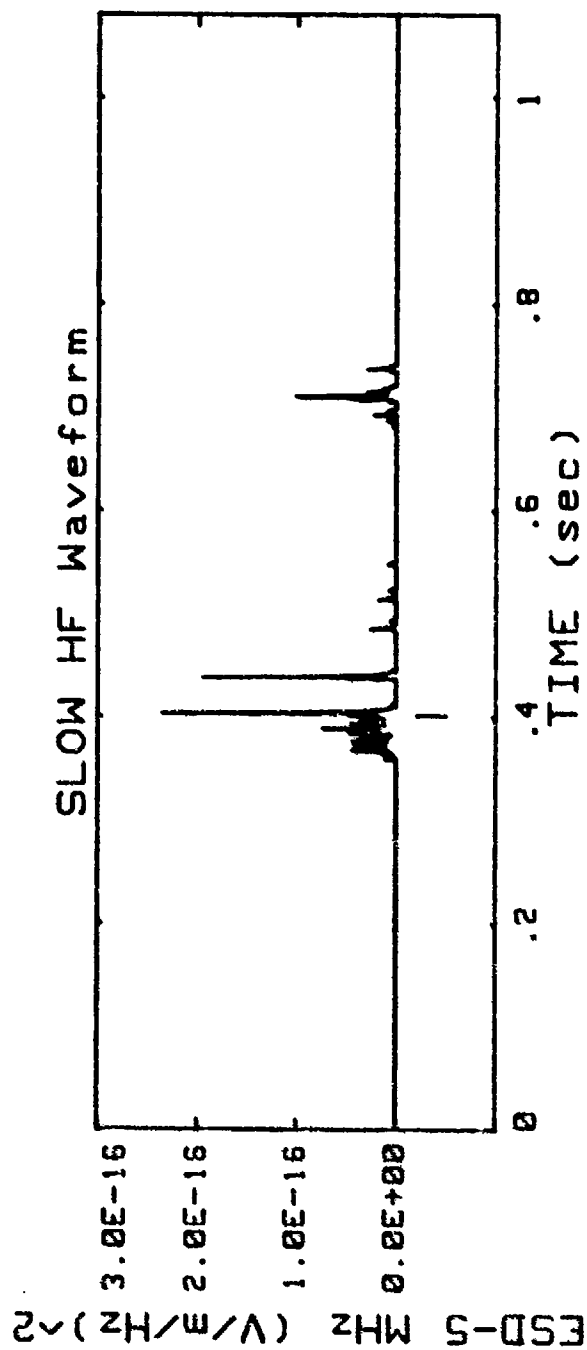
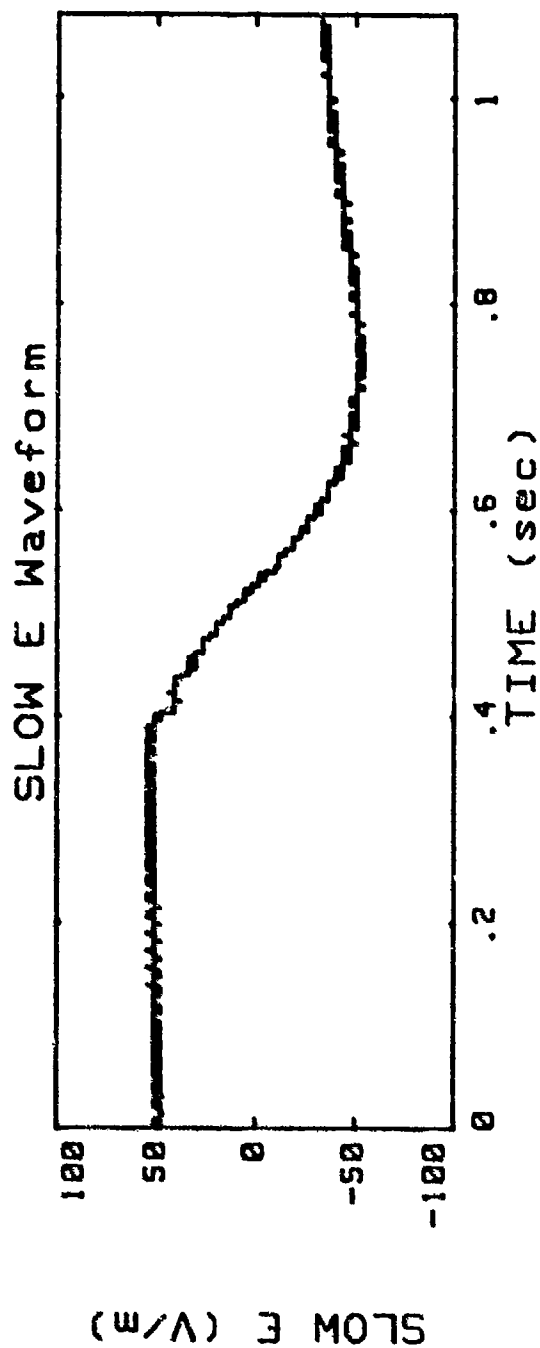


220202935.069 1985

Stepped Leader (29.4 Km)

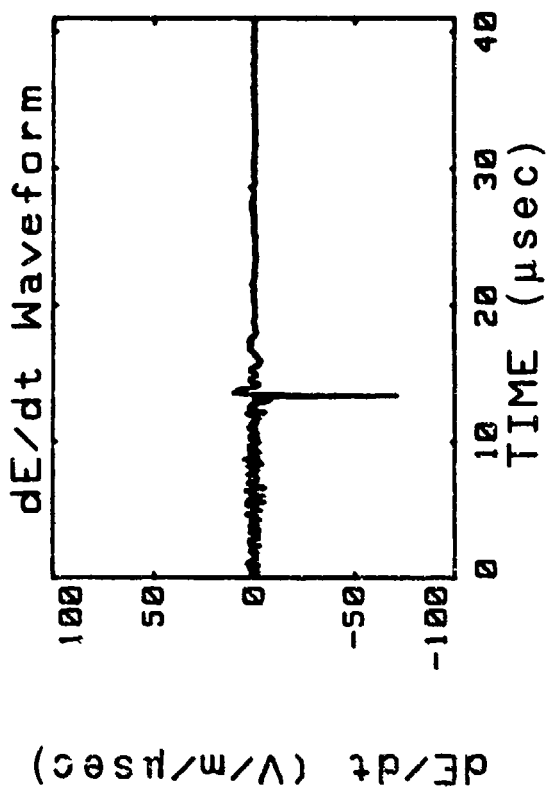
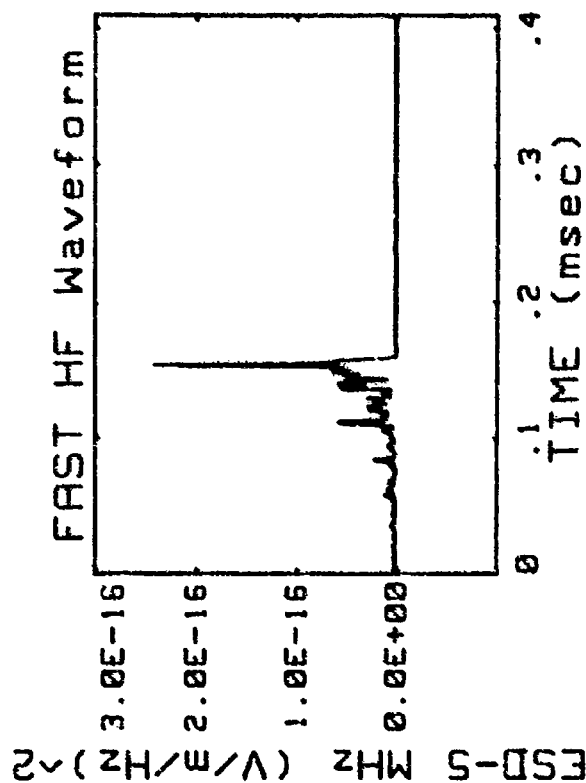
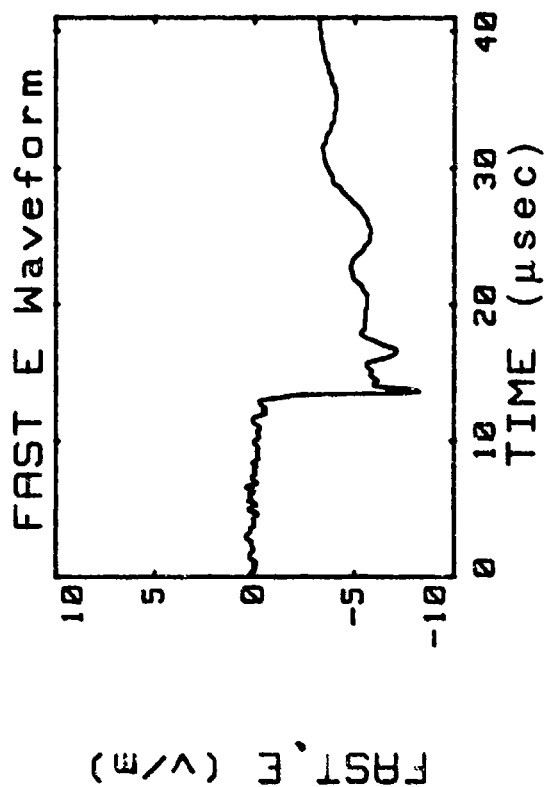
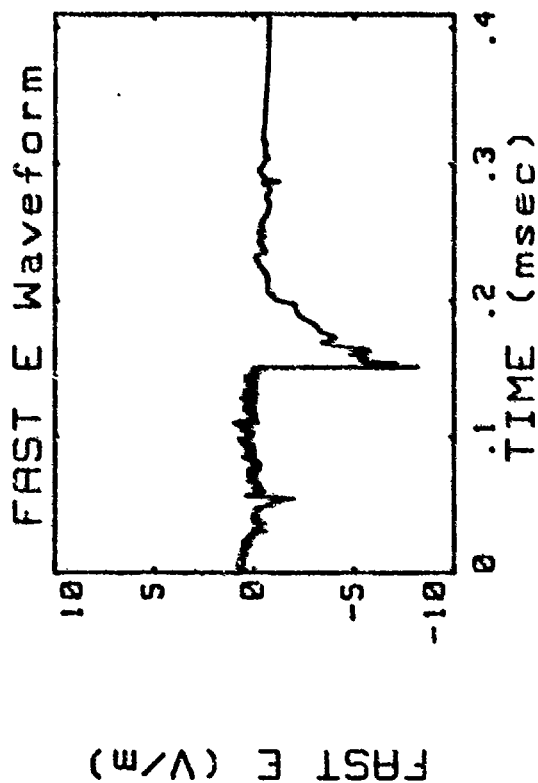


20:29:34.680 8 Aug 1985 (29.4 Km)

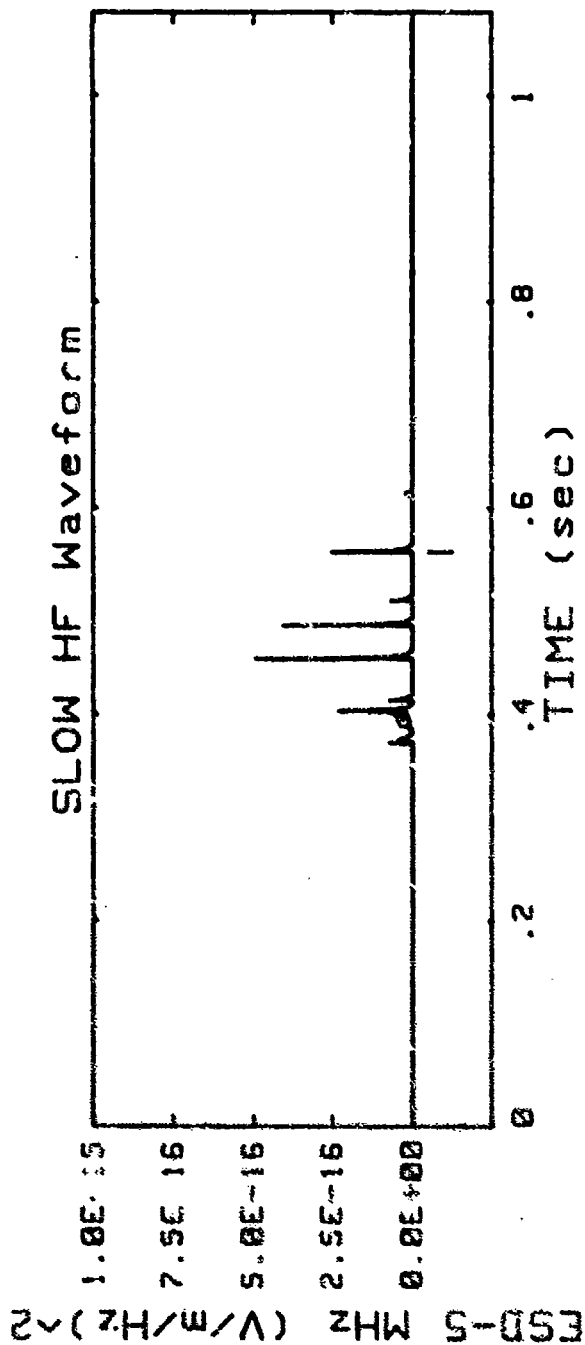
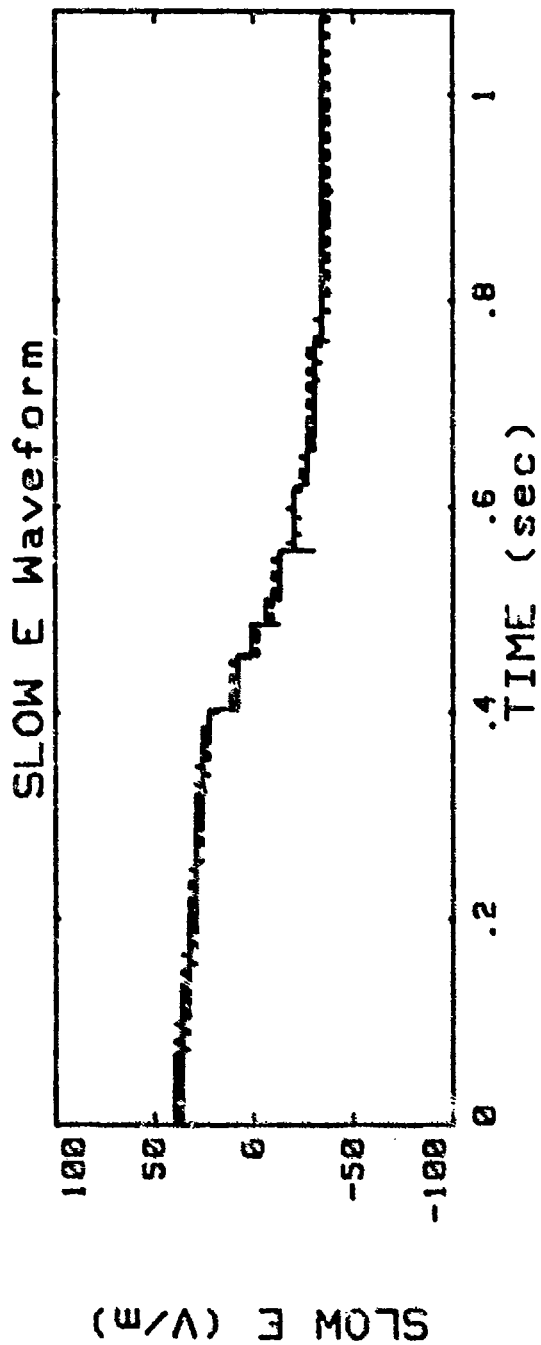


220202949.379 1985

Chaotic Subs RS (33.9 Km)

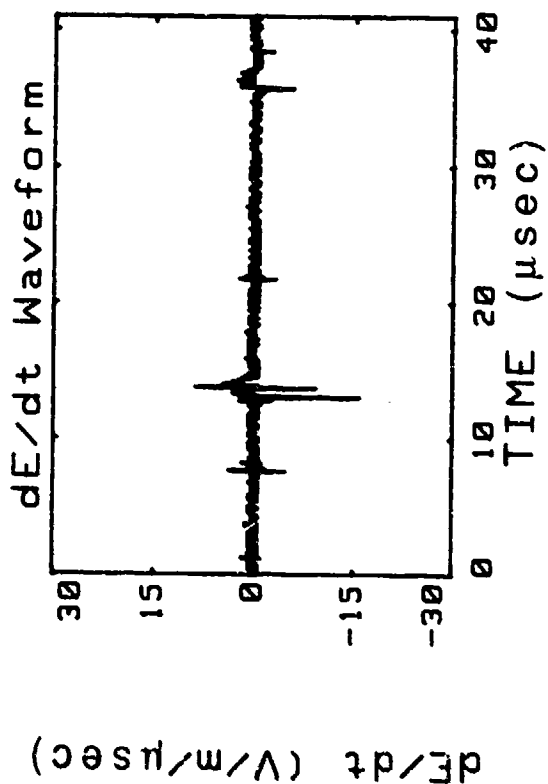
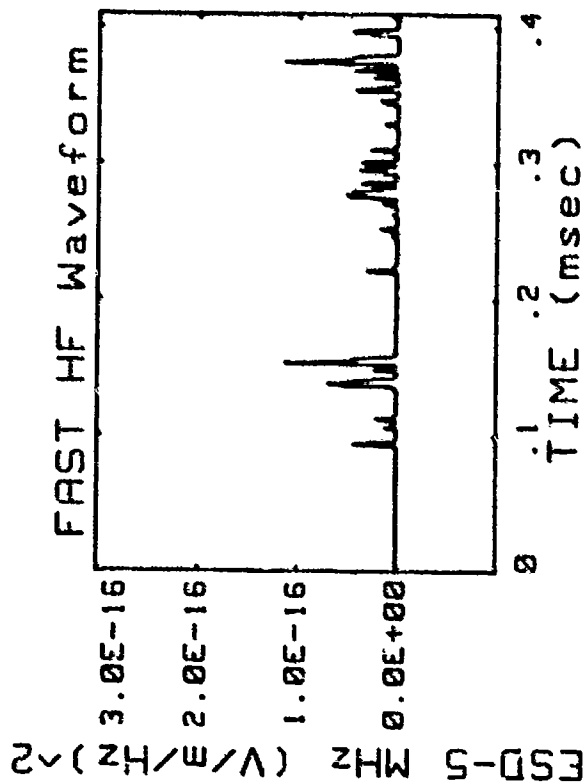
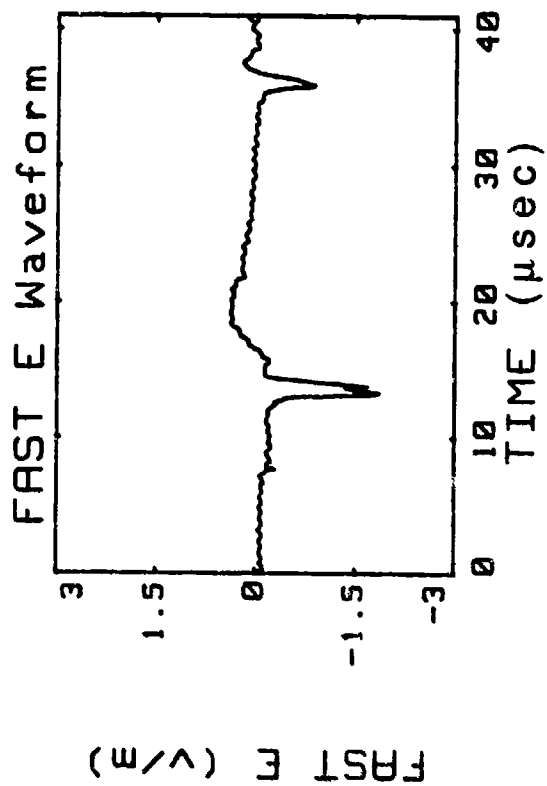
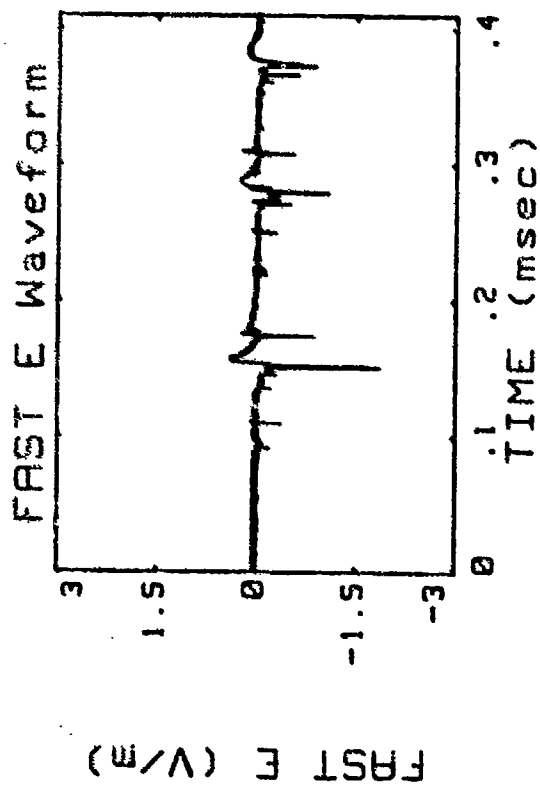


20:29:48.834 8 Aug 1985 (33.9 Km)

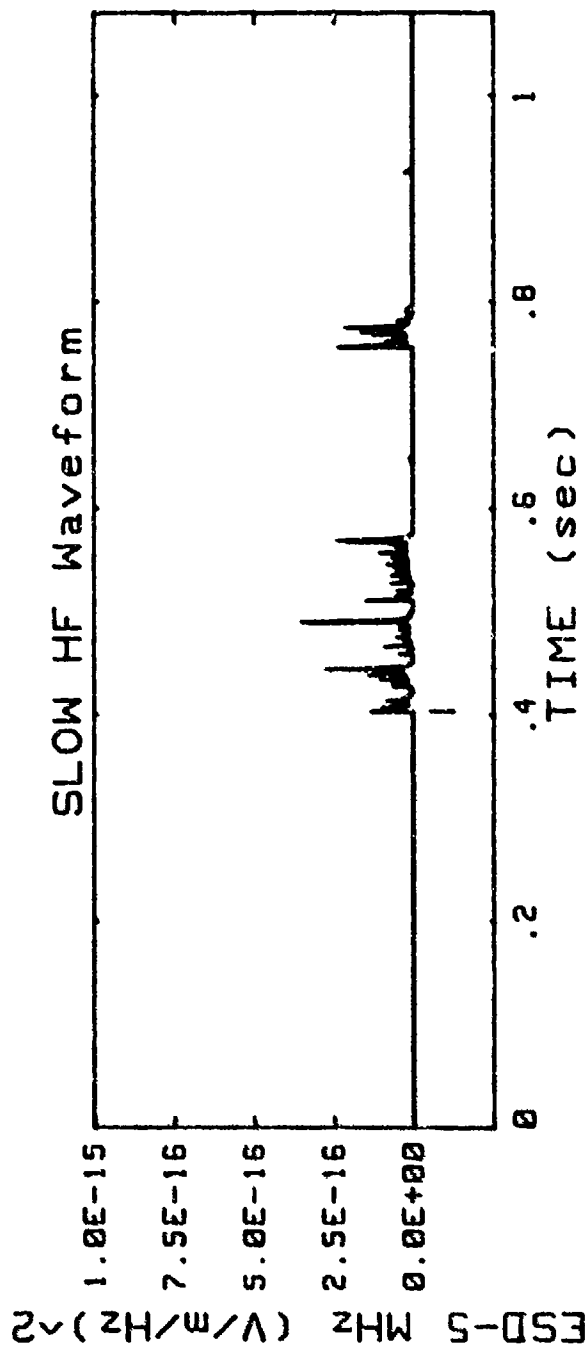
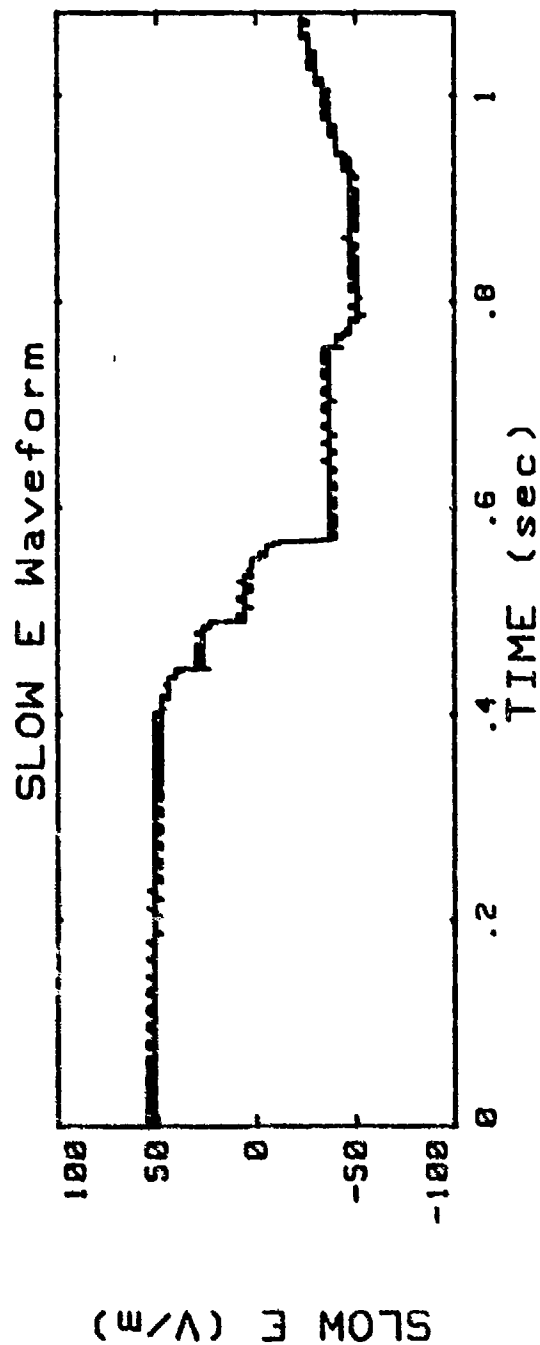


220202957.960 1985

Char Cloud Pulse (29.9 Km)

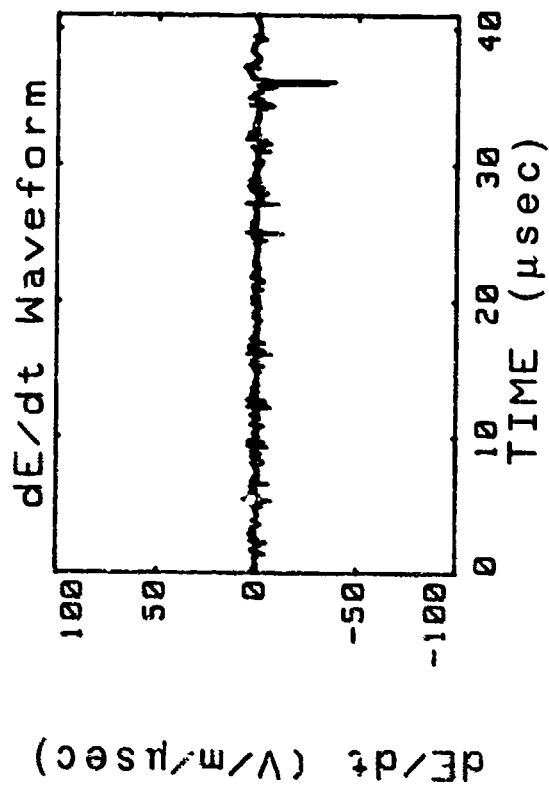
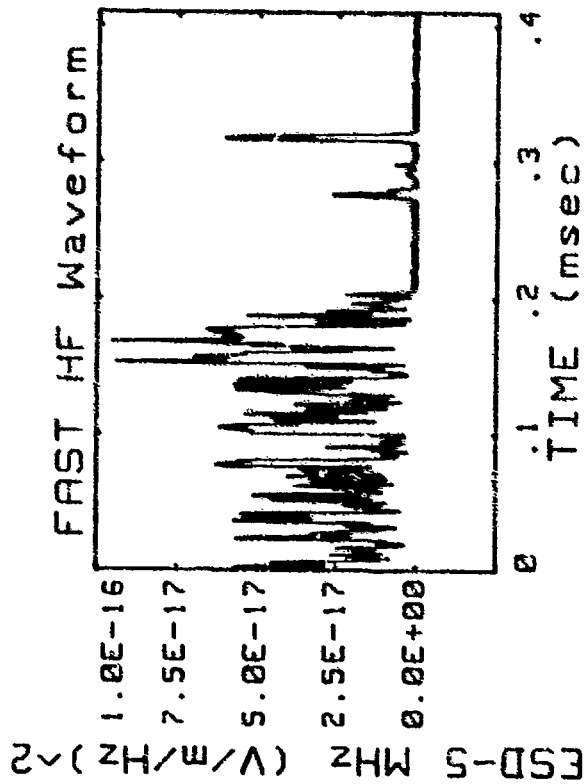
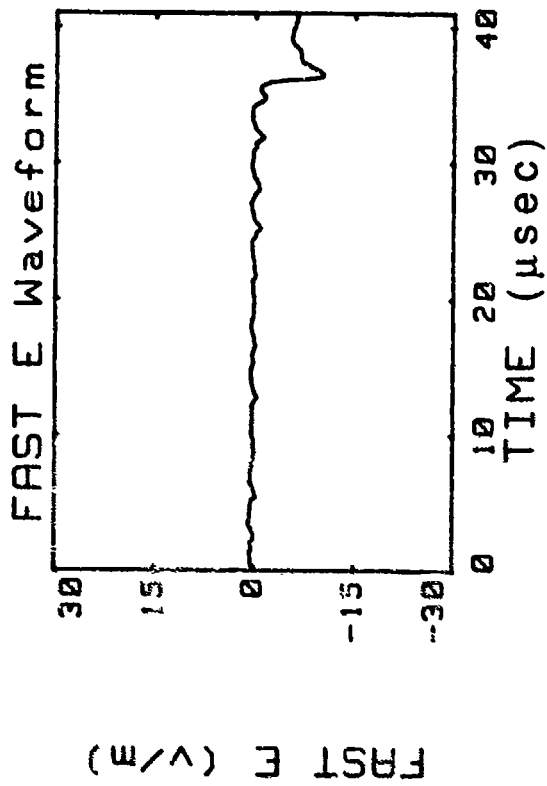
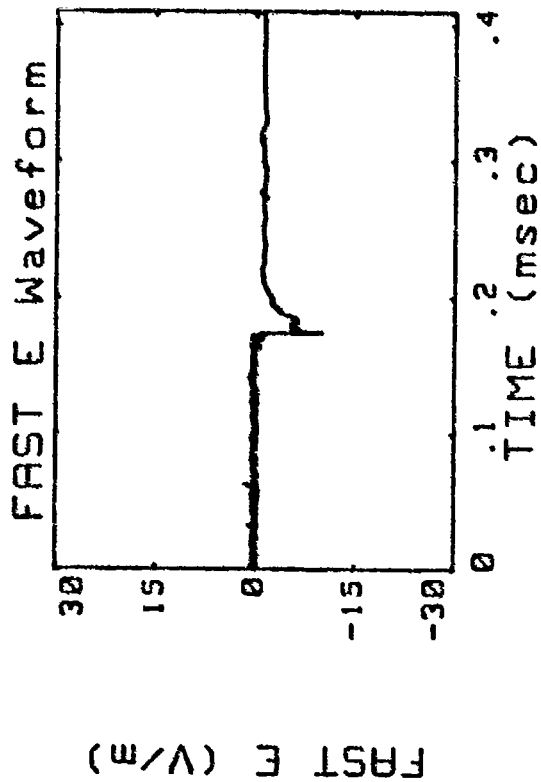


20:25:37.569 8 Aug 1985 (29.9 Km)



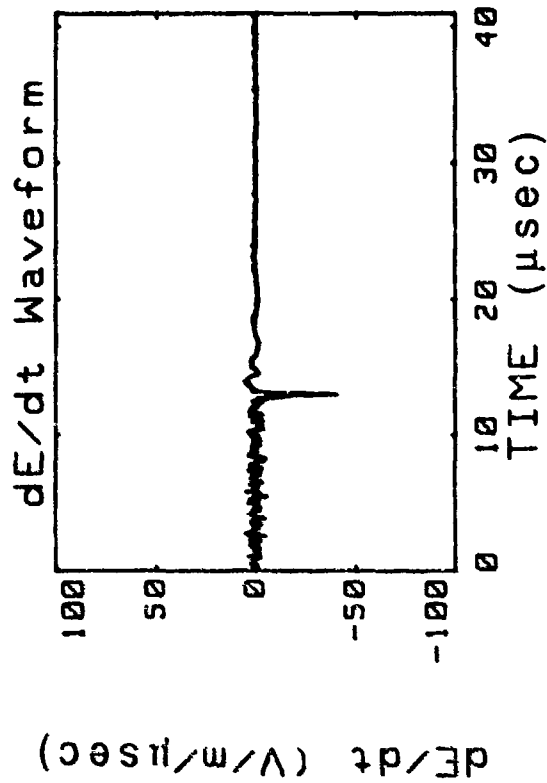
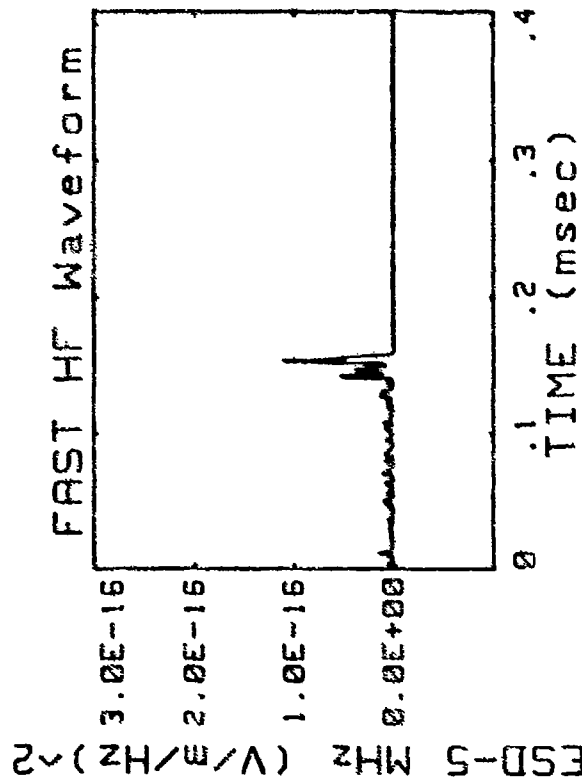
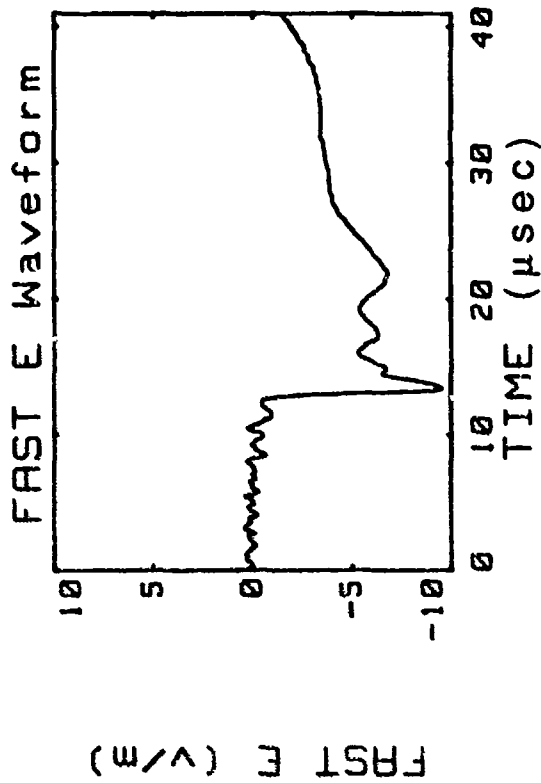
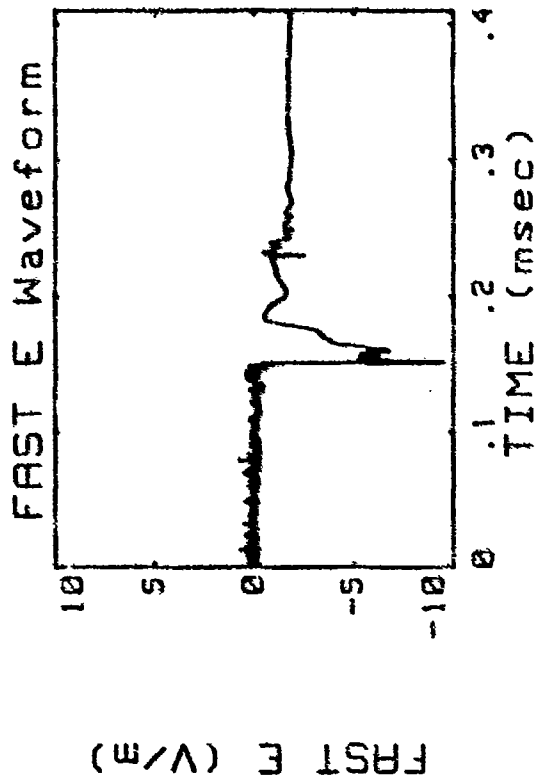
220203024.523 1985

DS Subs RS (32.8 Km)



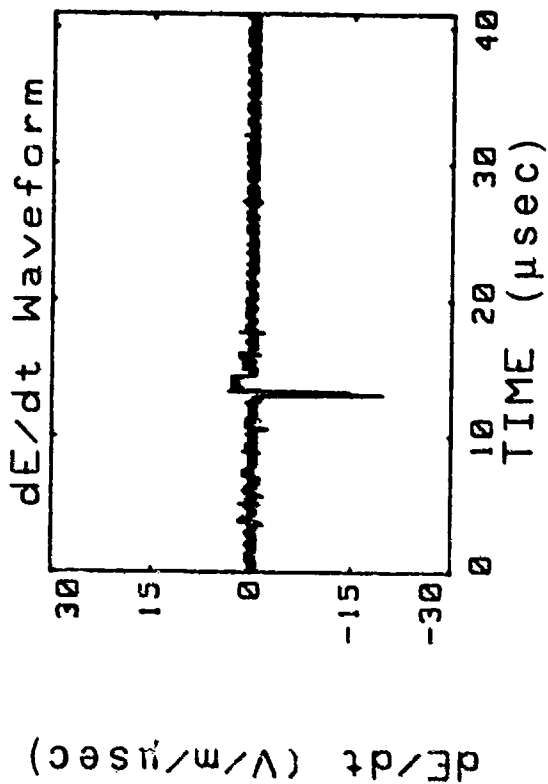
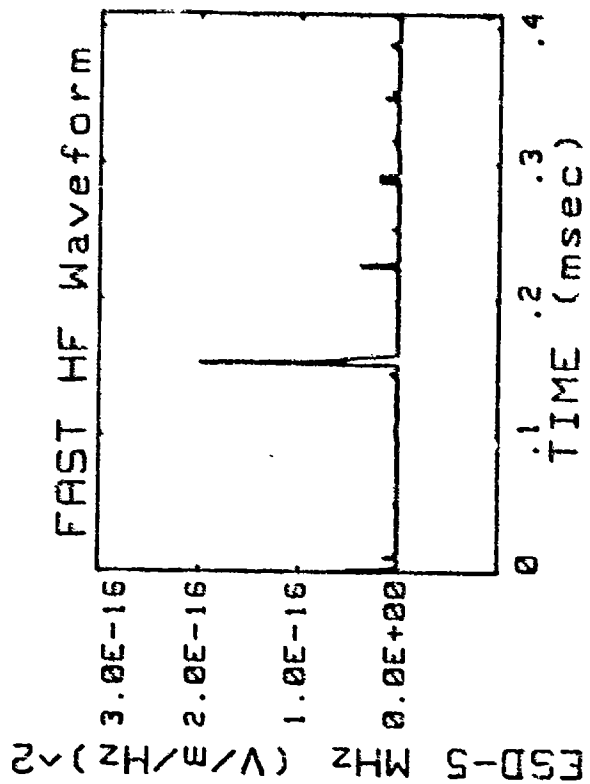
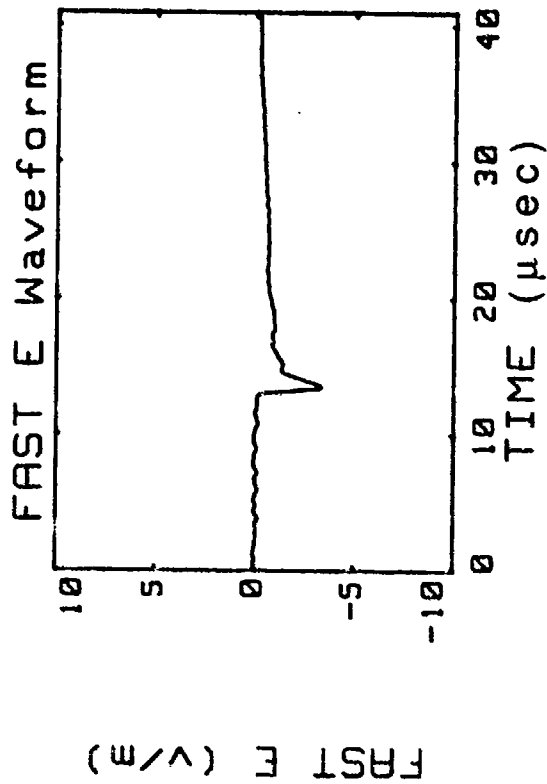
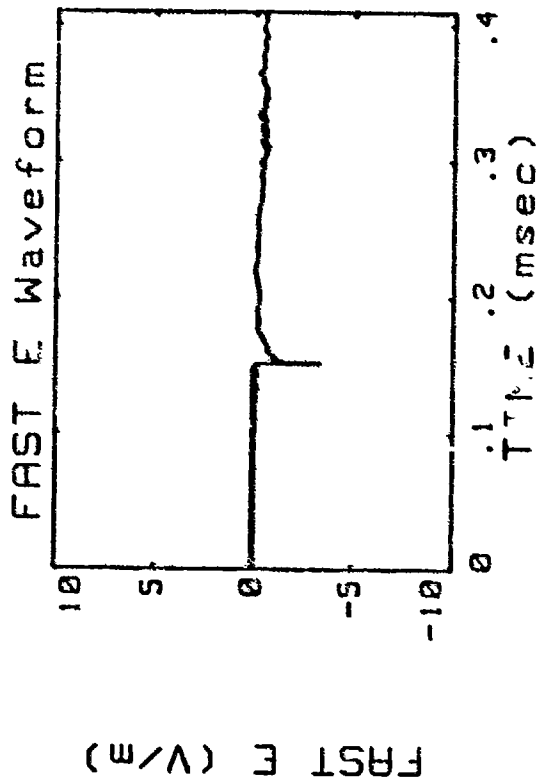
220203024.634 1985

Chaotic Subs RS (32.8 Km)

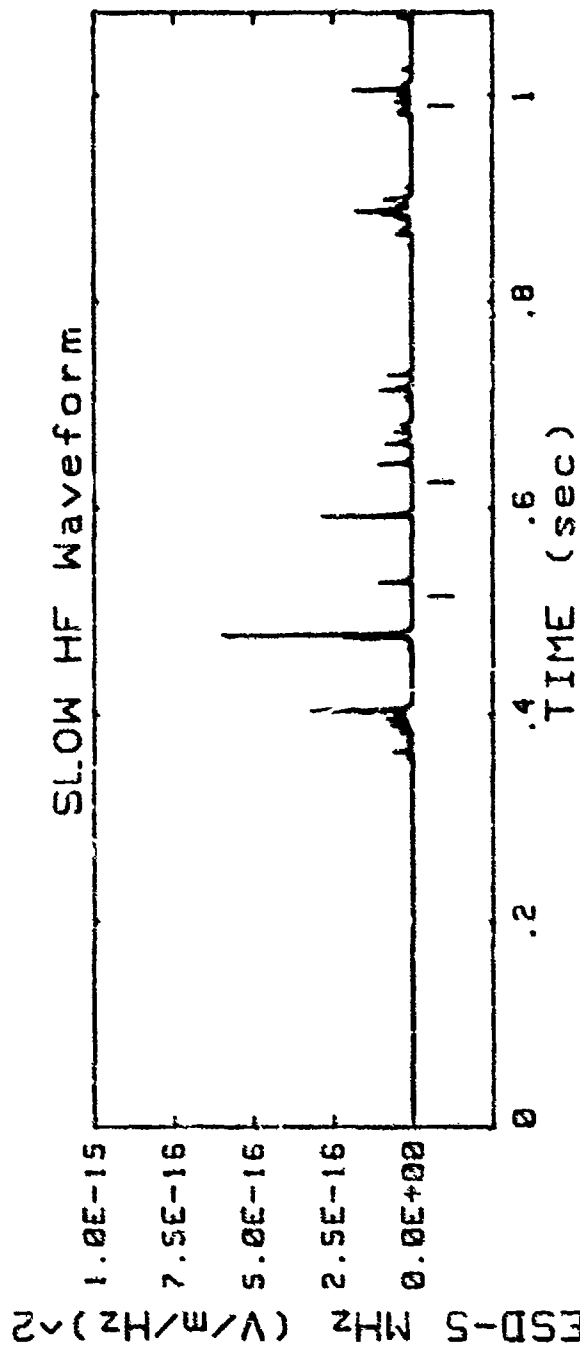
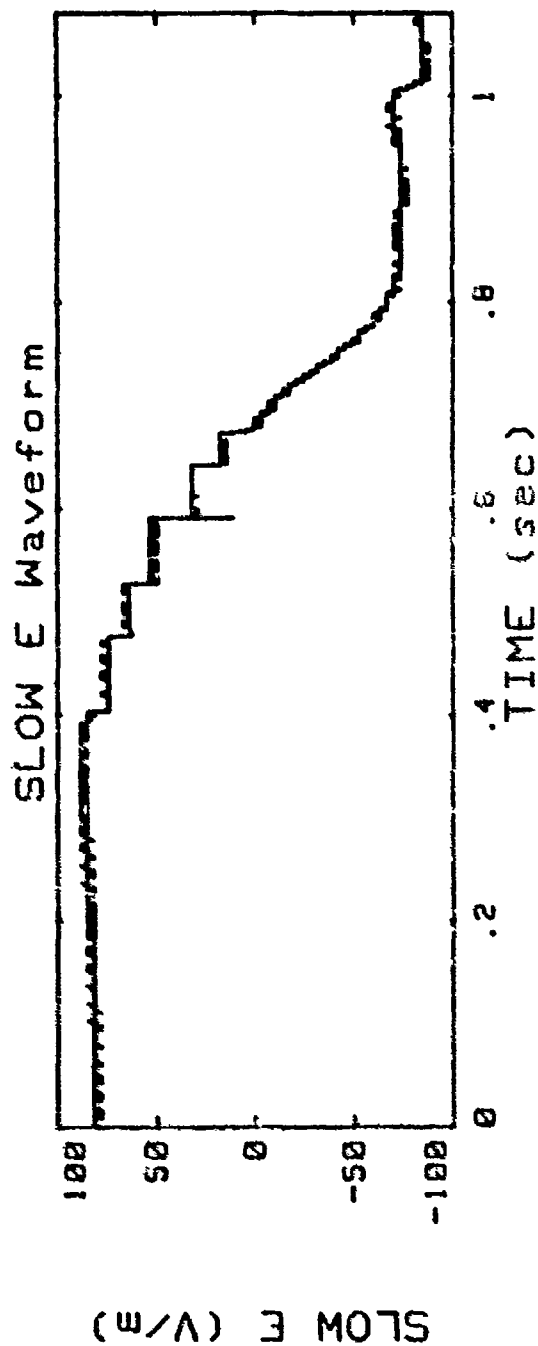


220203024.998 1985

Norm Subs RS (32.8 Km)

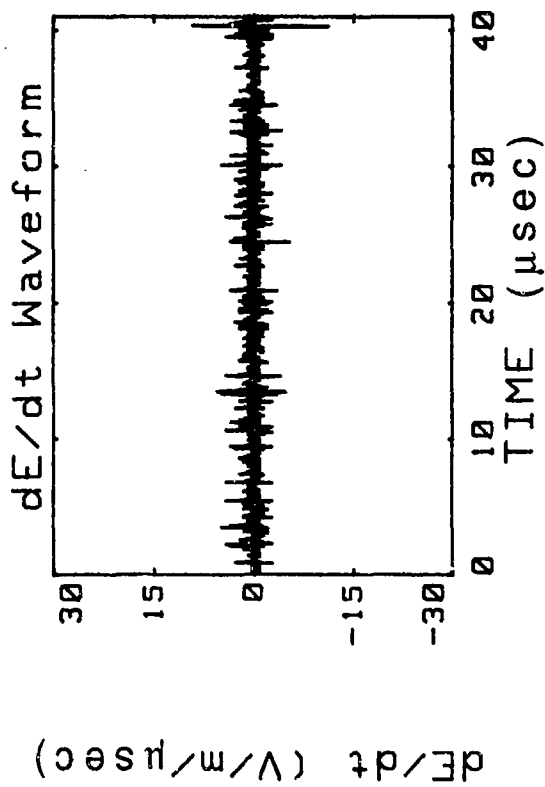
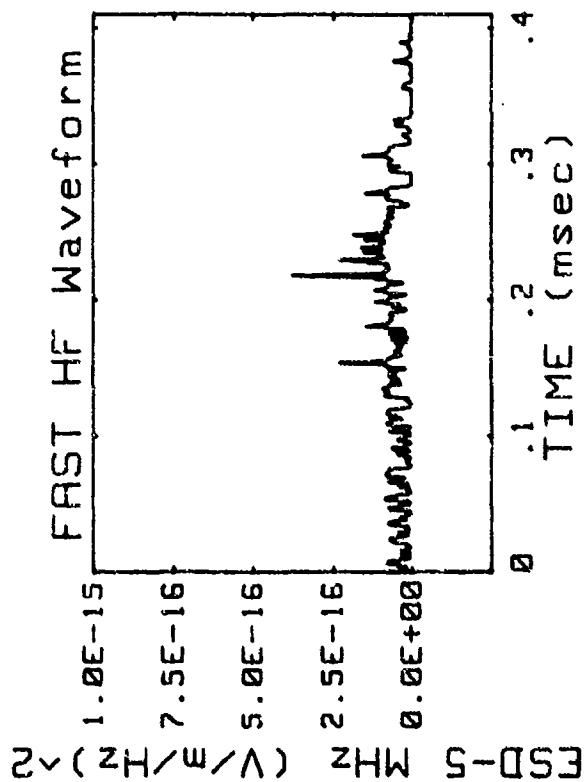
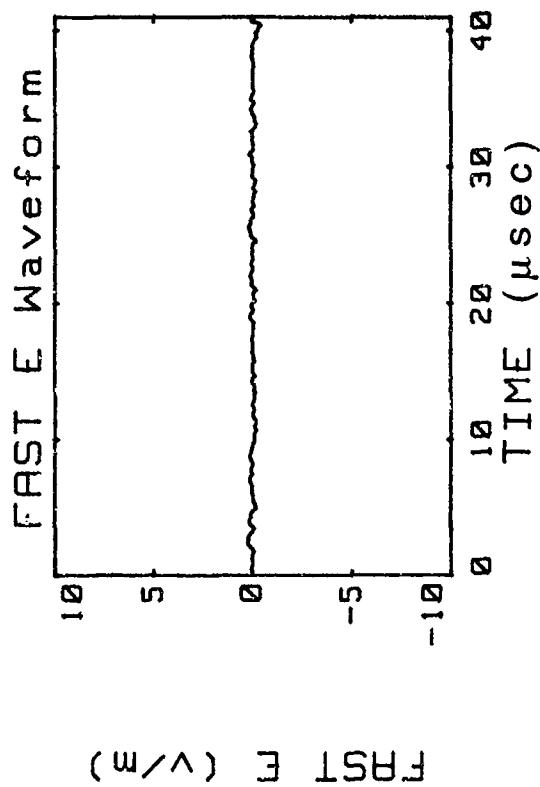
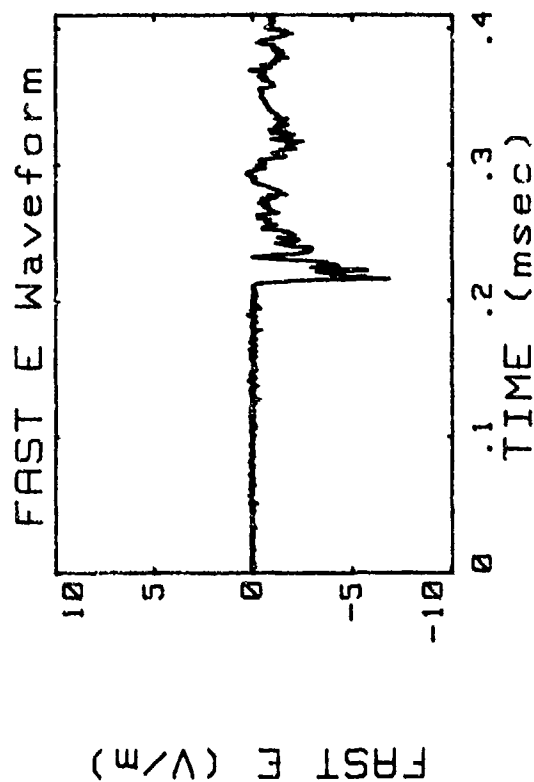


20:30:24.021 8 Aug 1985 (32.8 Km)



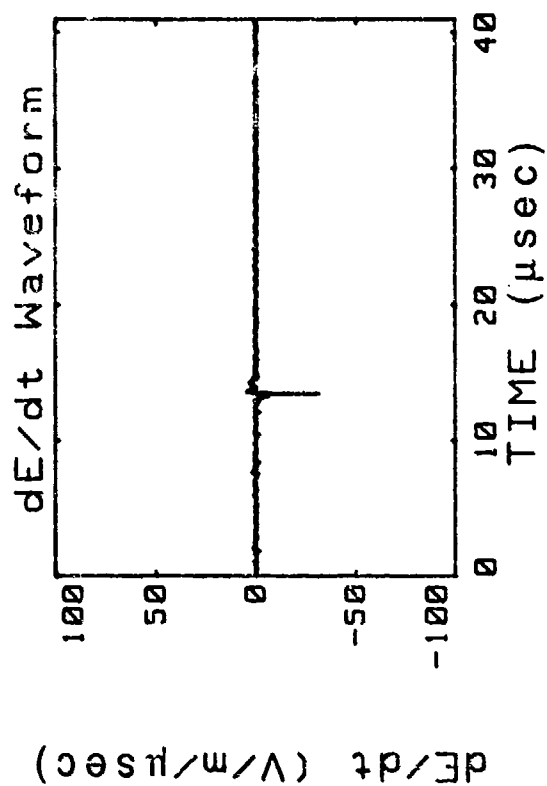
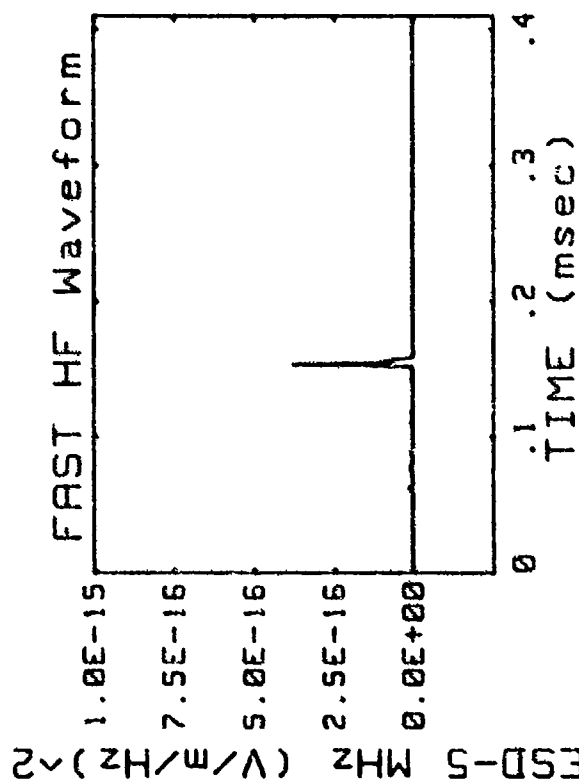
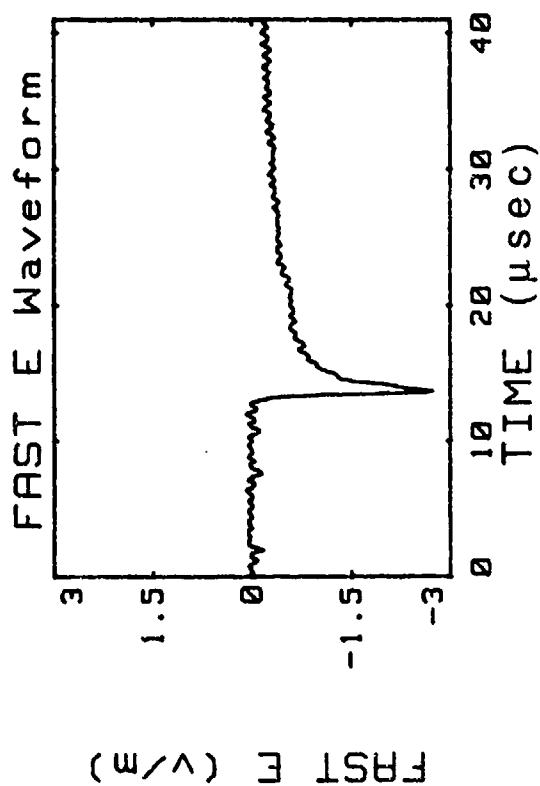
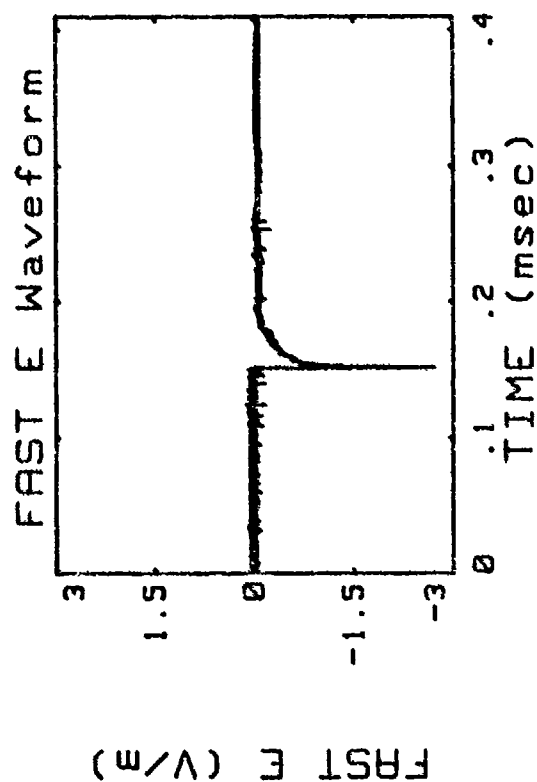
220203031.569 1985

Stepped Leader (38.2 Km)

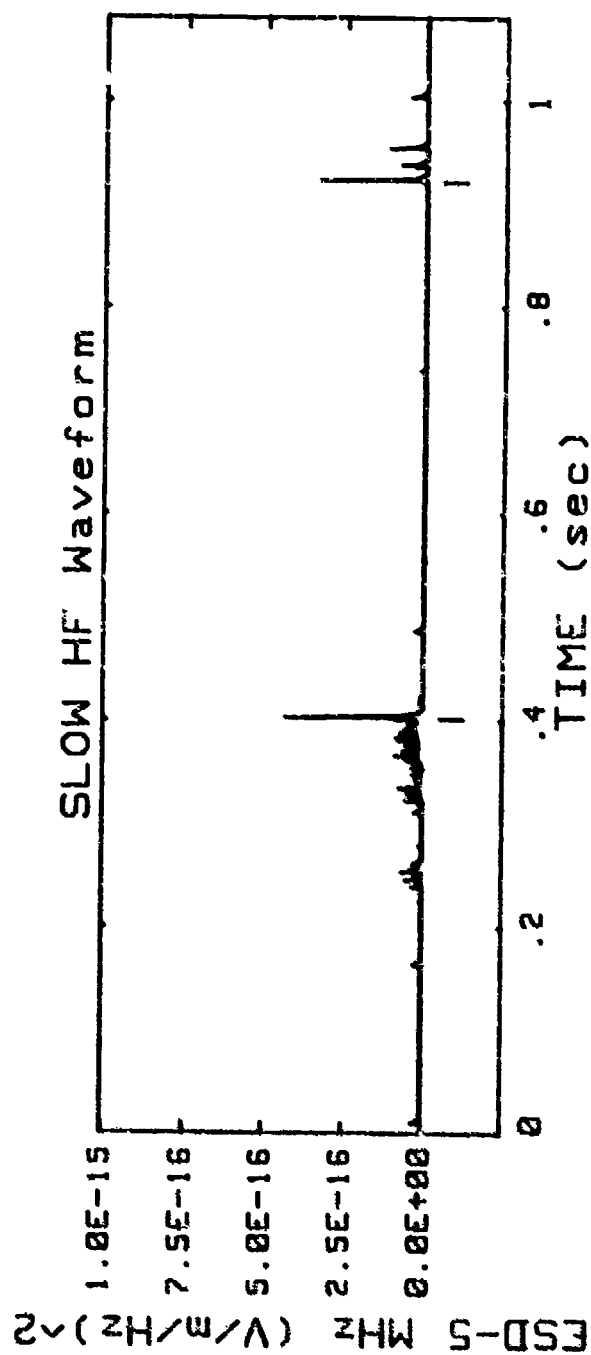
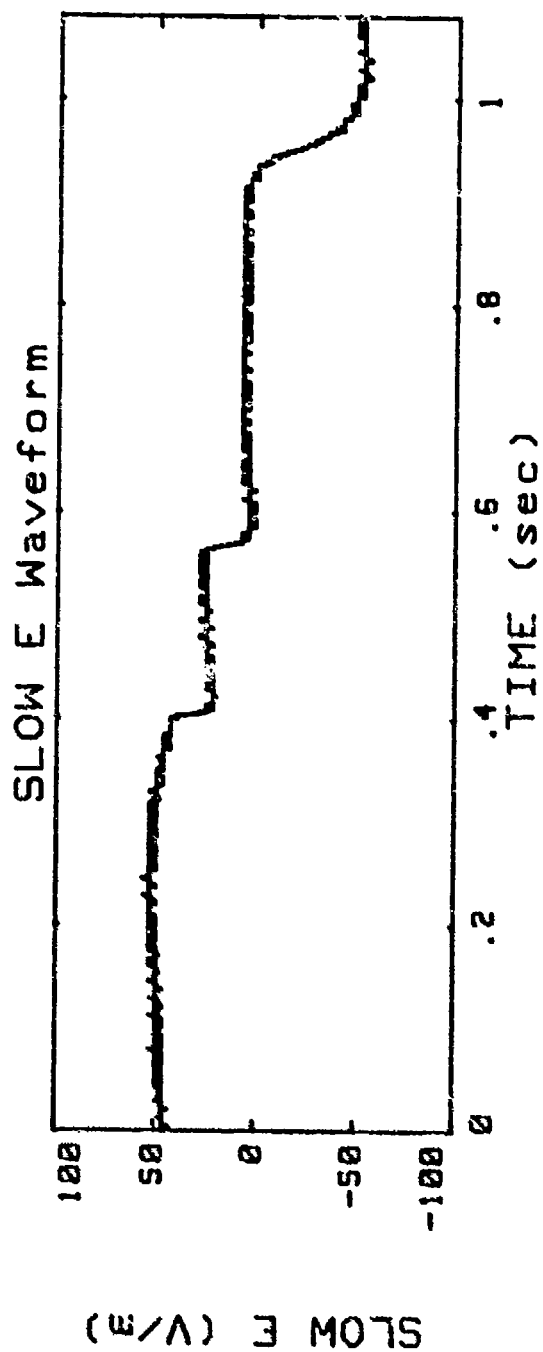


220203032.089 1985

DS Subs RS (38.2 Km)

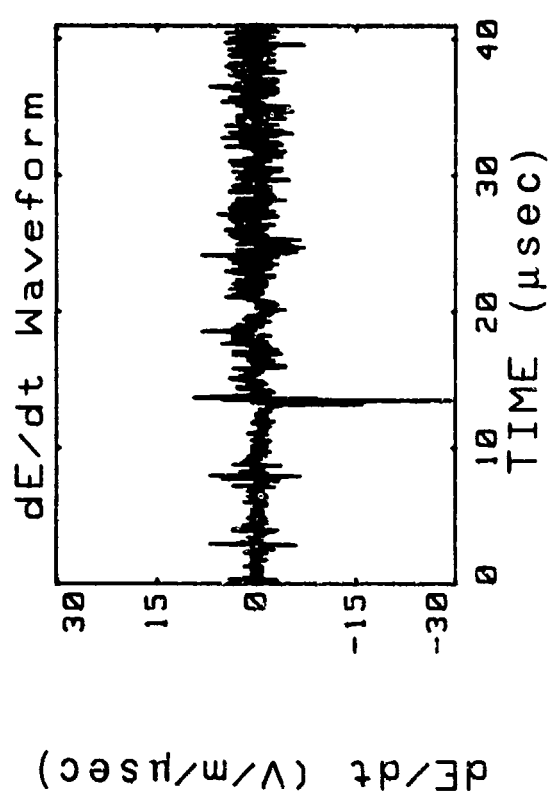
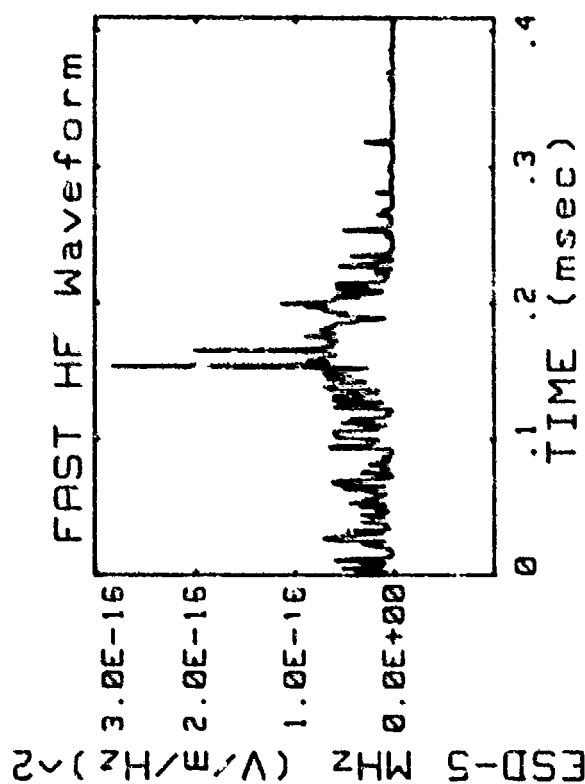
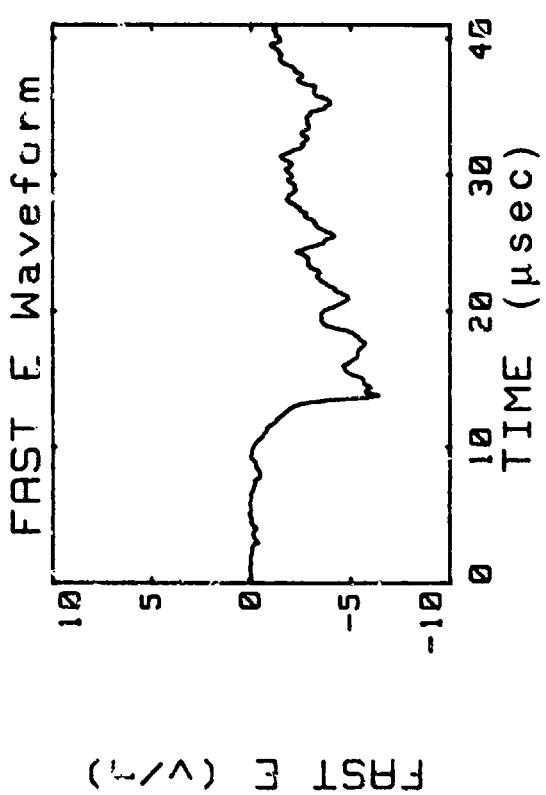
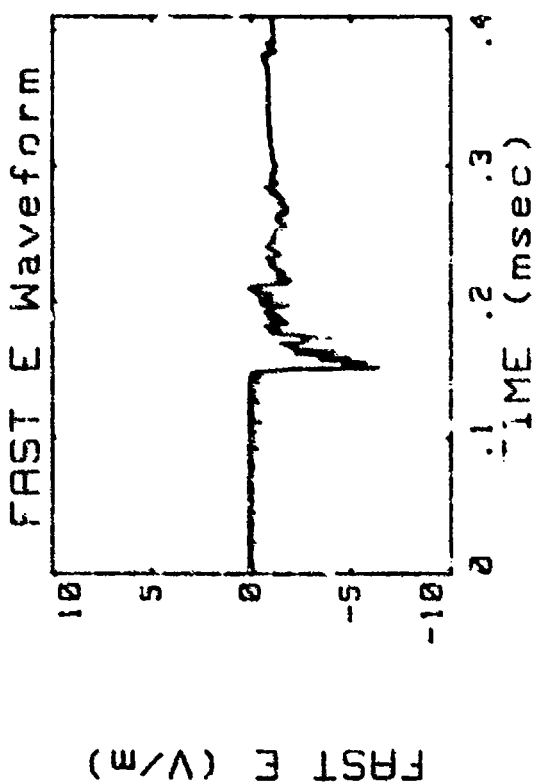


20:30:31.180 8 Aug 1985 (38.2 Km)

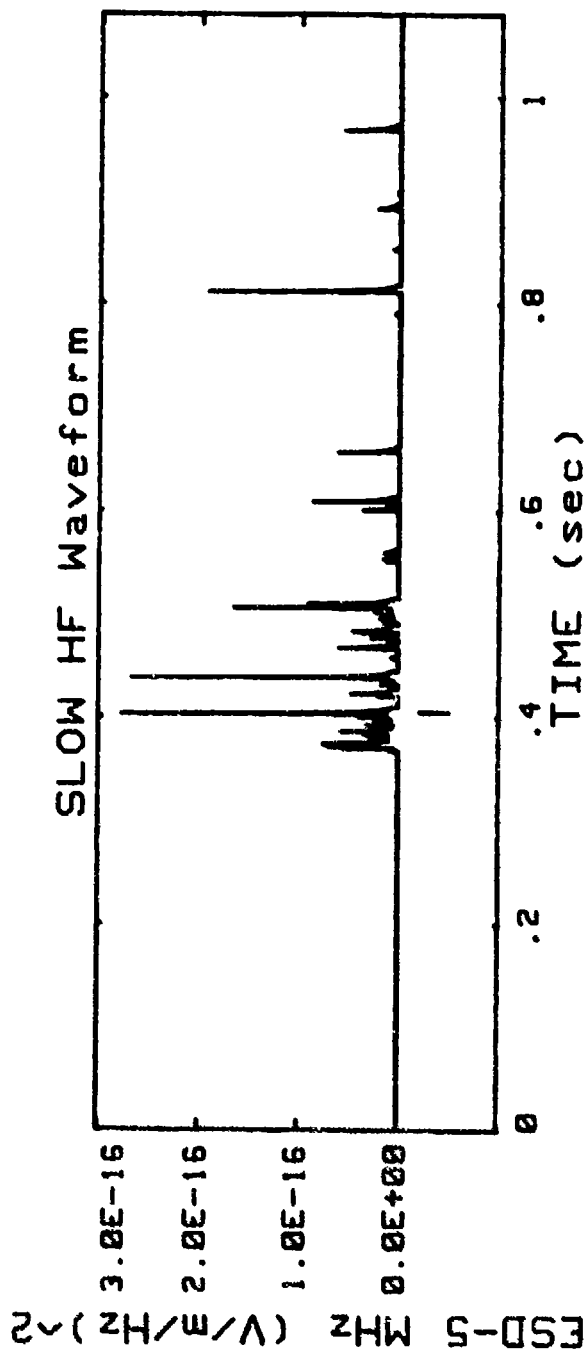
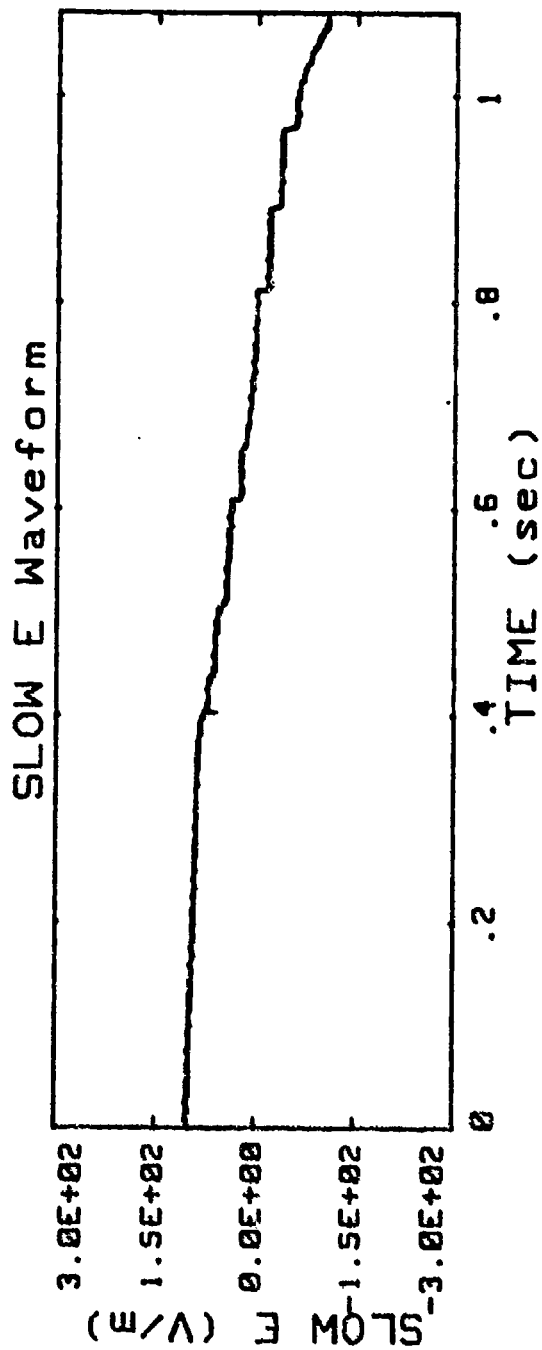


220203148.402 1985

1st RS (34.1 Km)

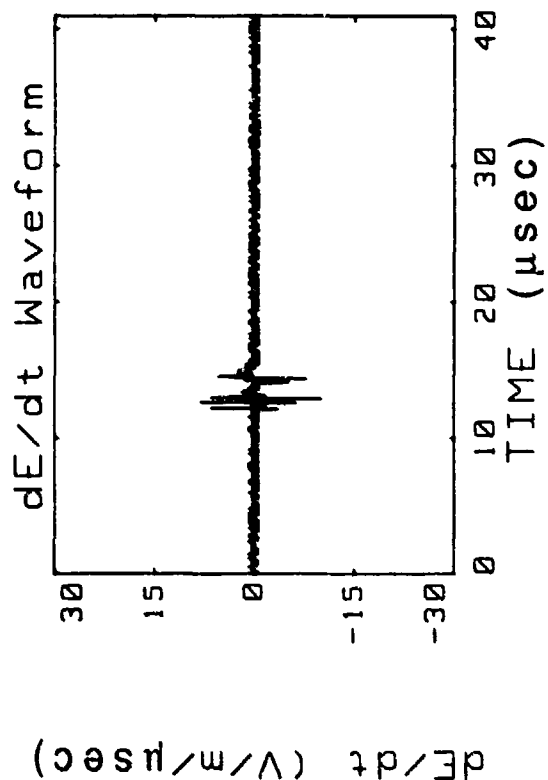
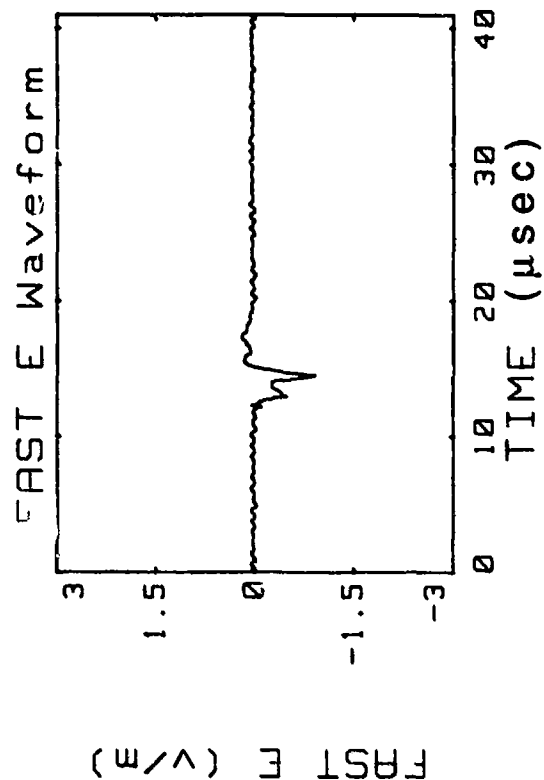
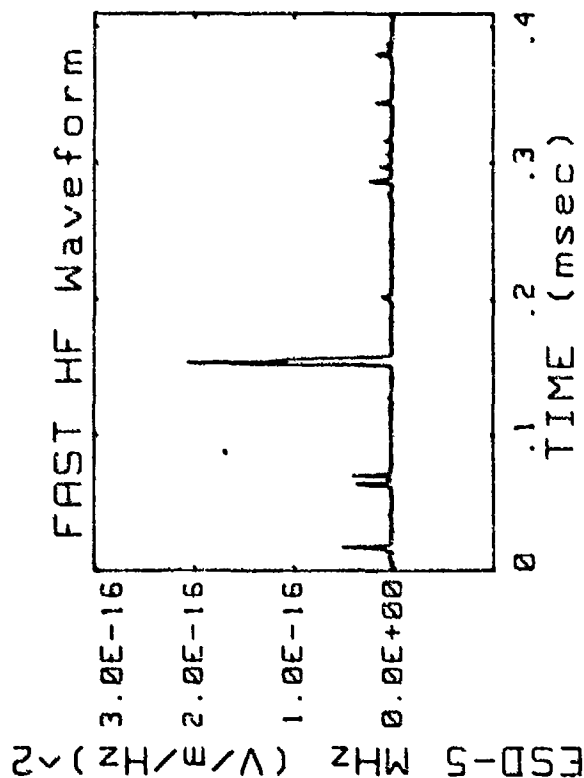
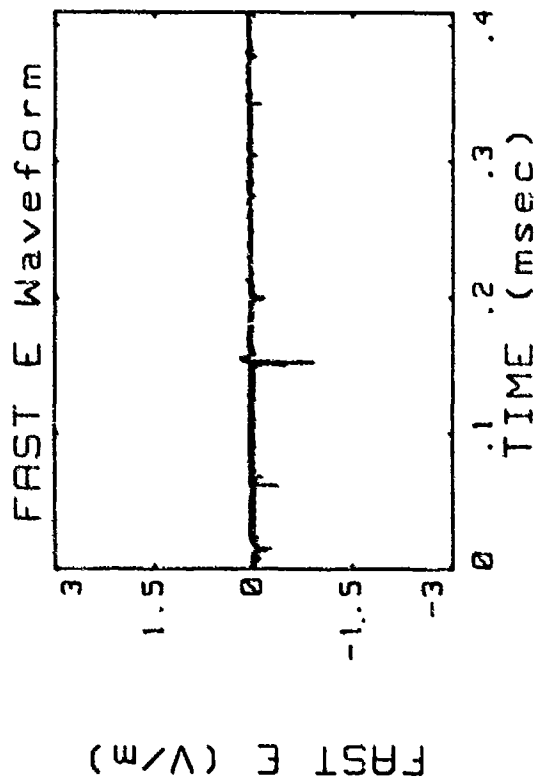


20:31:48.009 8 Aug 1985 (34.1 Km)

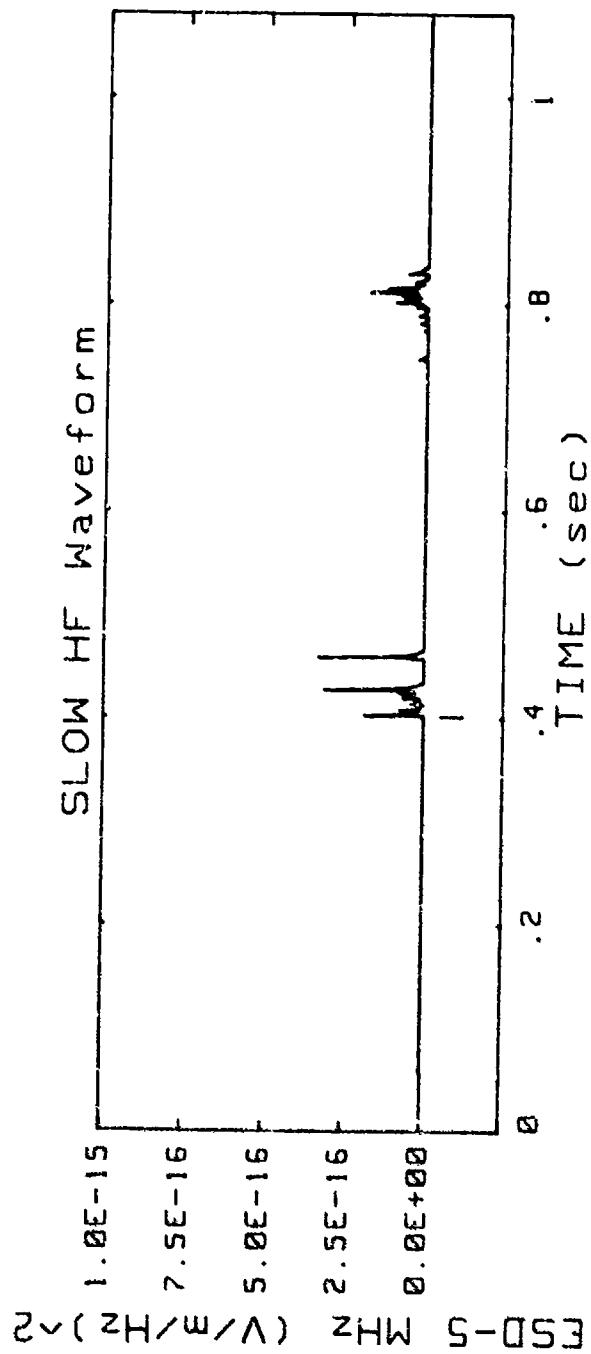
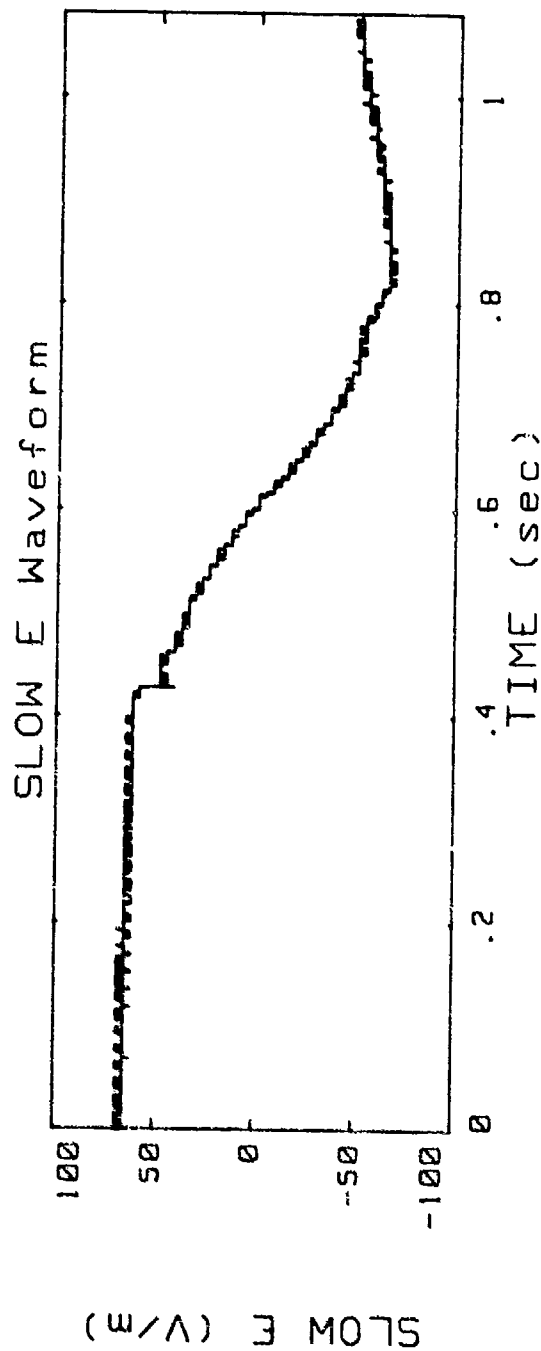


220203220.878 1985

Char Cloud Pulse (32.7 Km)

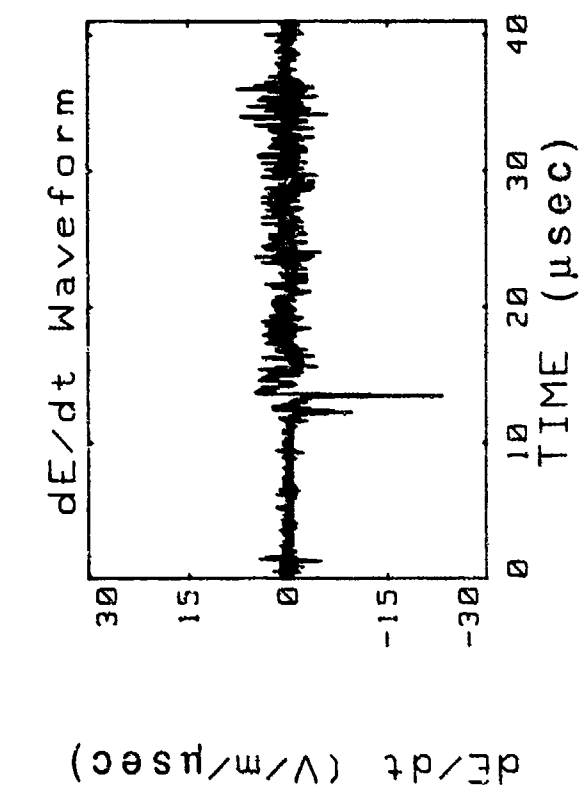
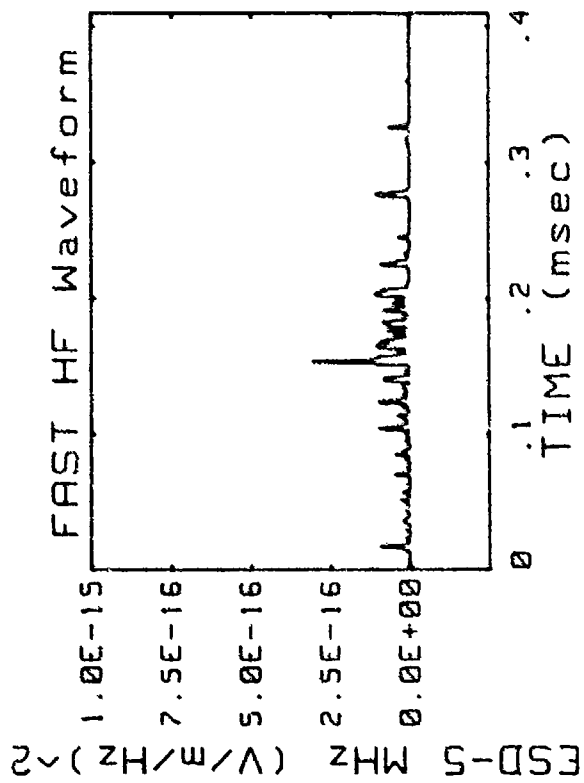
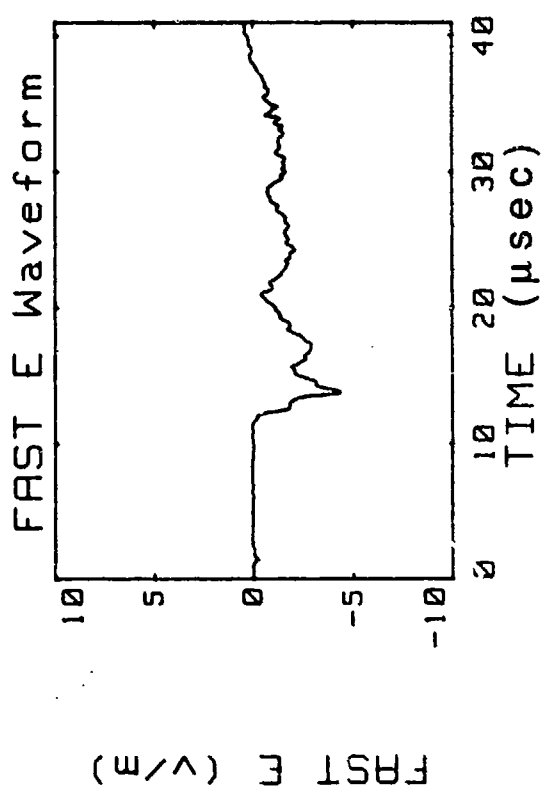
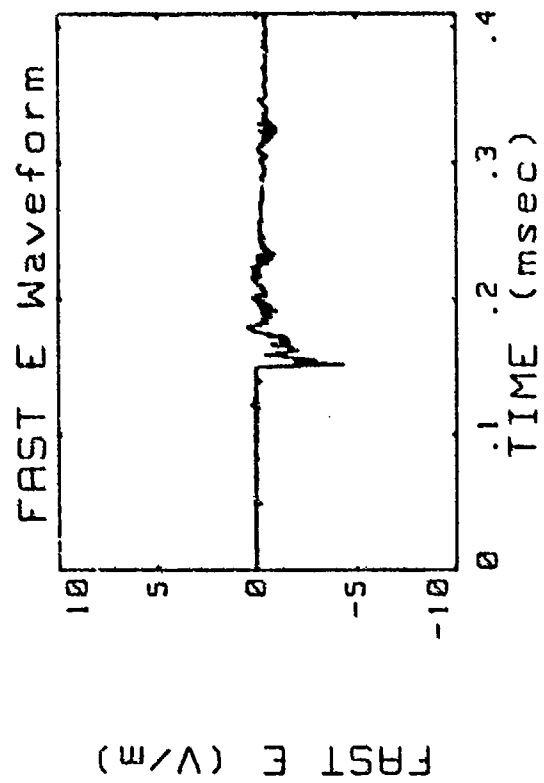


20:32:20.489 8 Aug 1985 (32.7 Km)



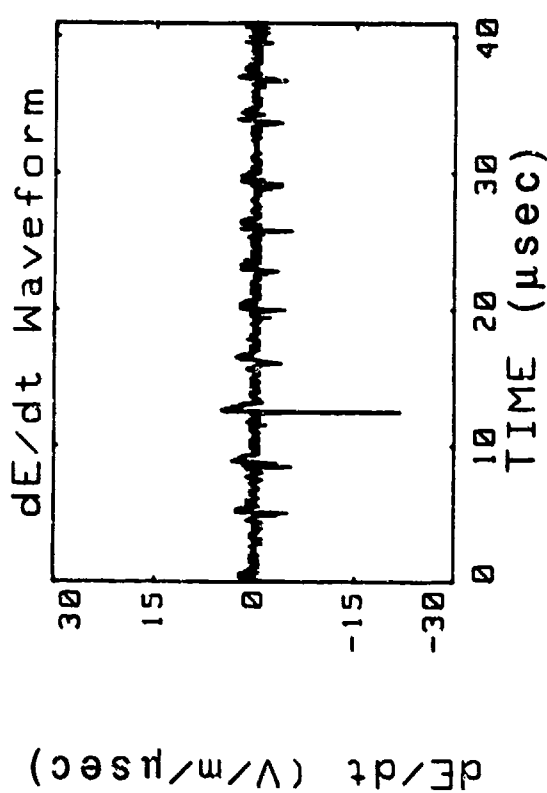
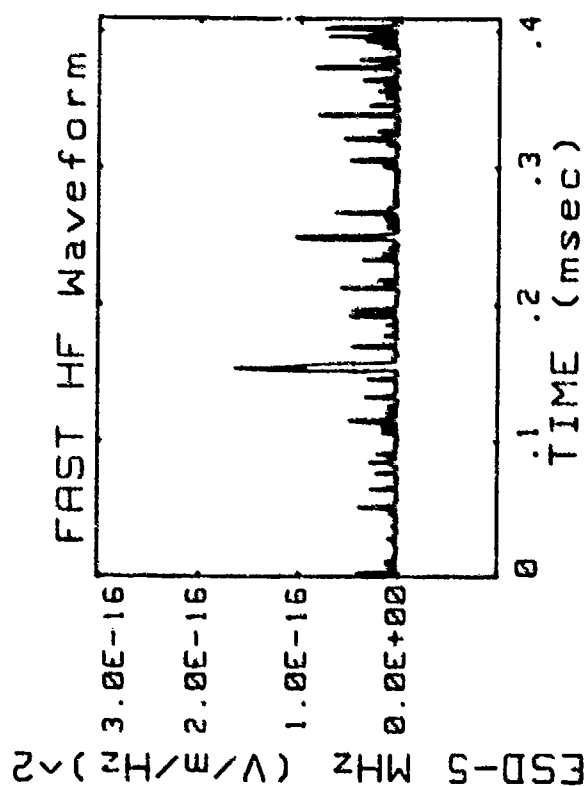
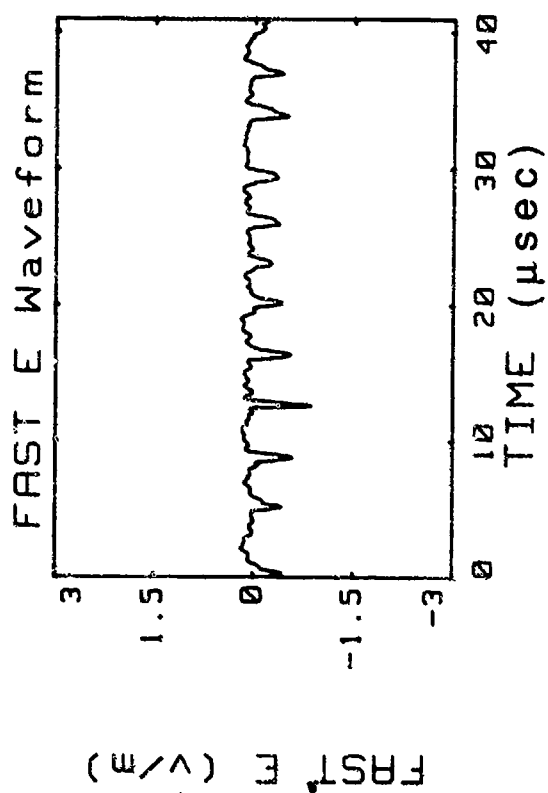
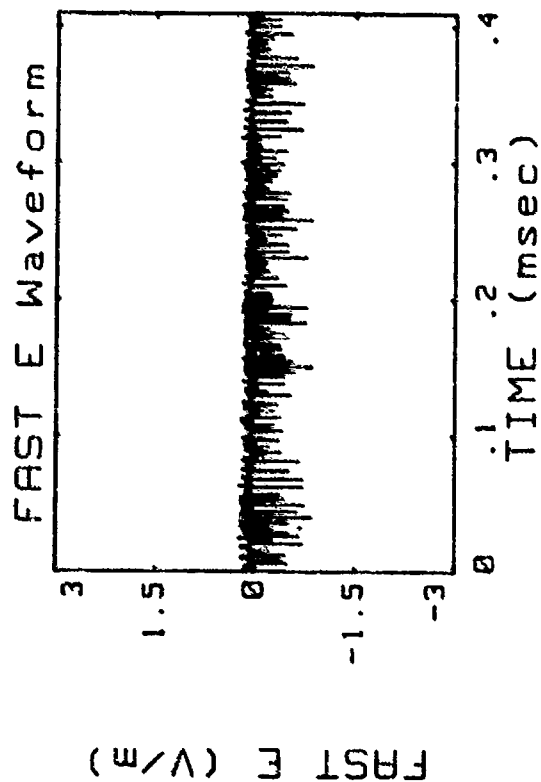
220203245.486 1985

1st RS (31.1 Km)

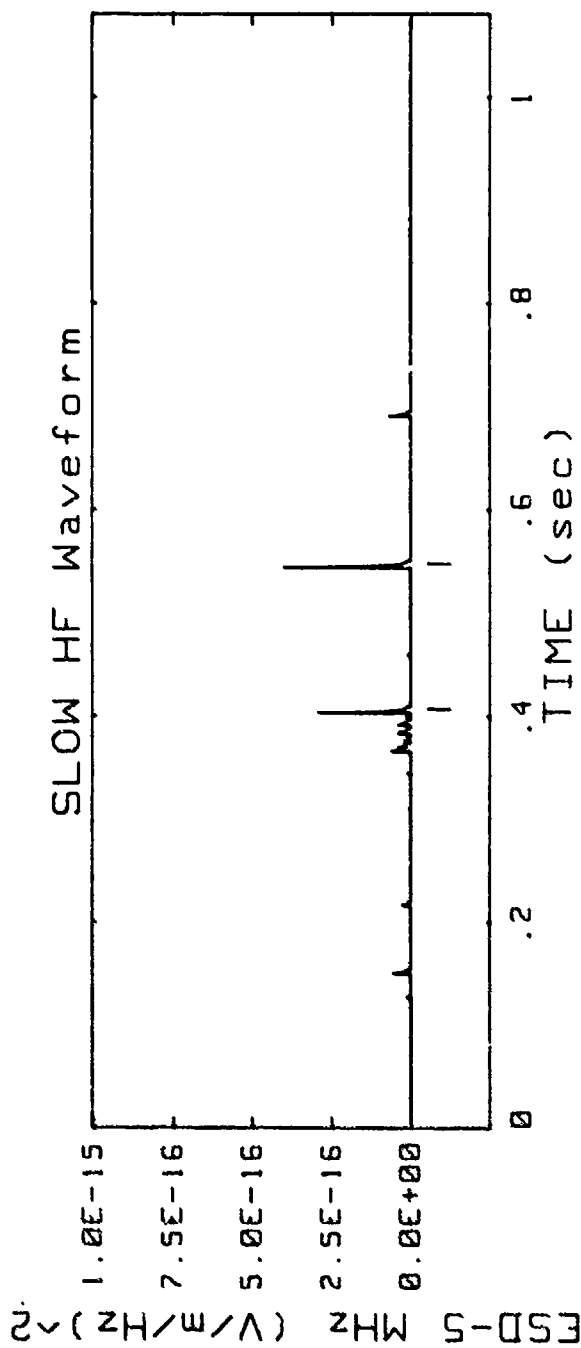
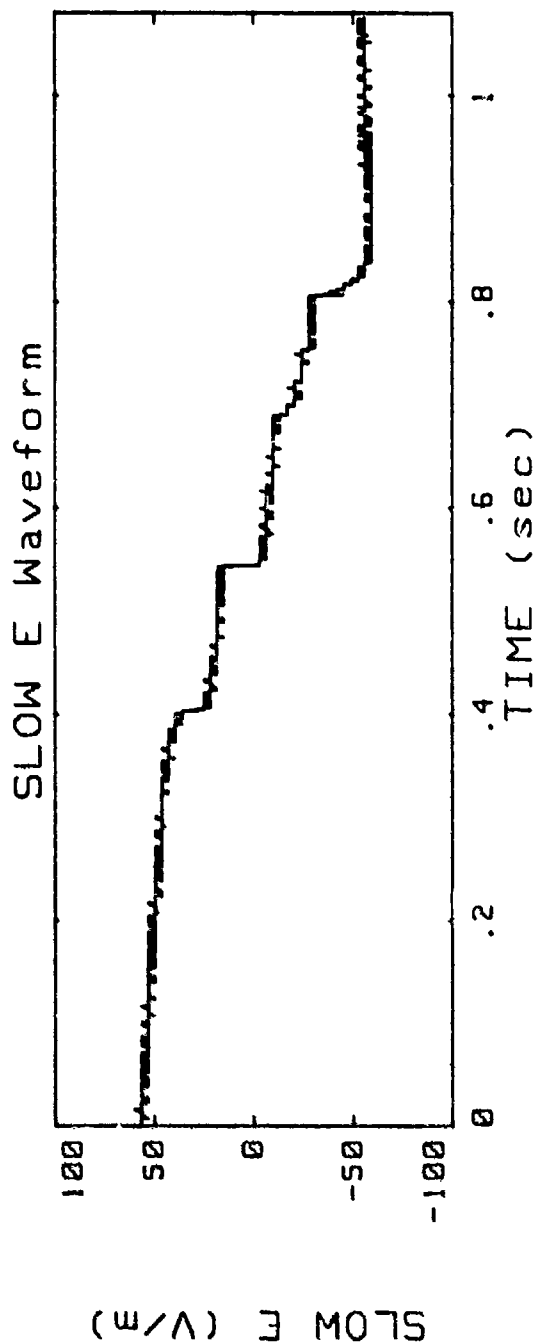


220203245.628 1985

DS Leader (31.1 Km)

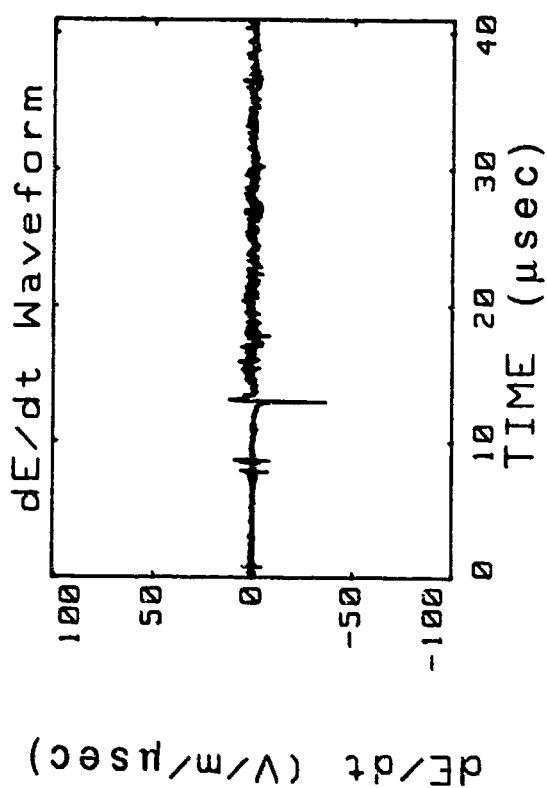
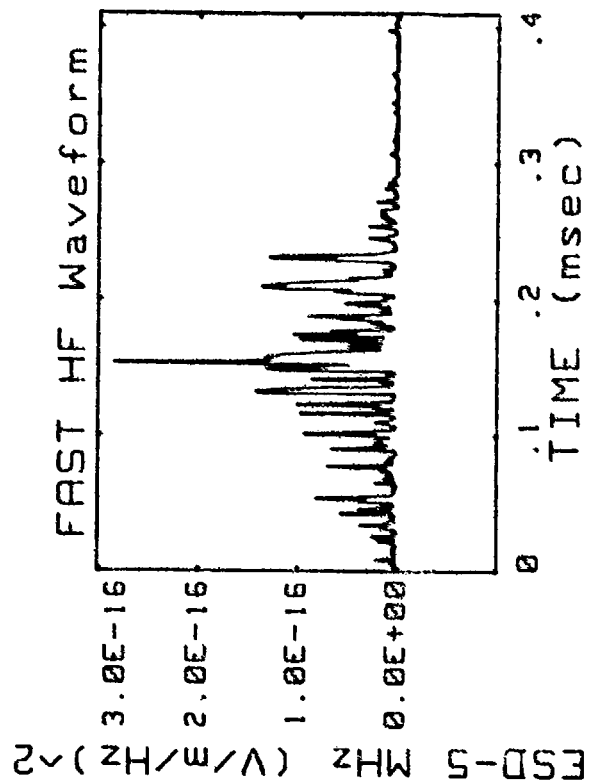
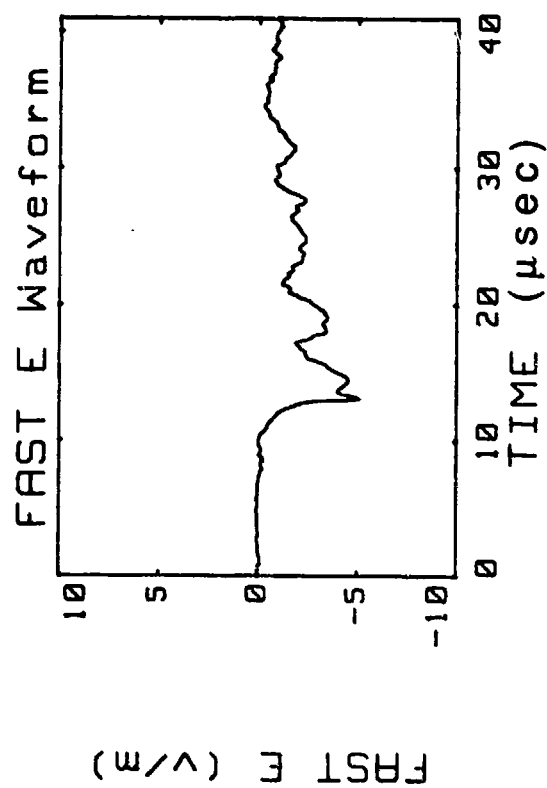
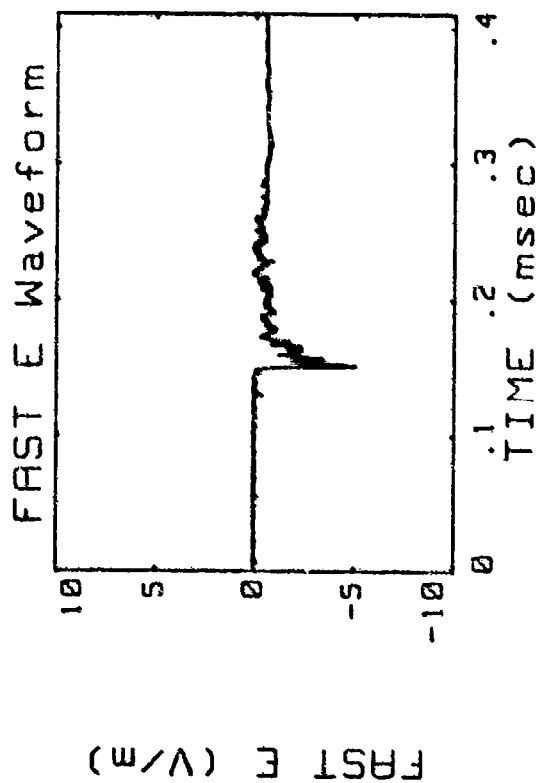


20:32:45.092 8 Aug 1985 (31.1 Km)

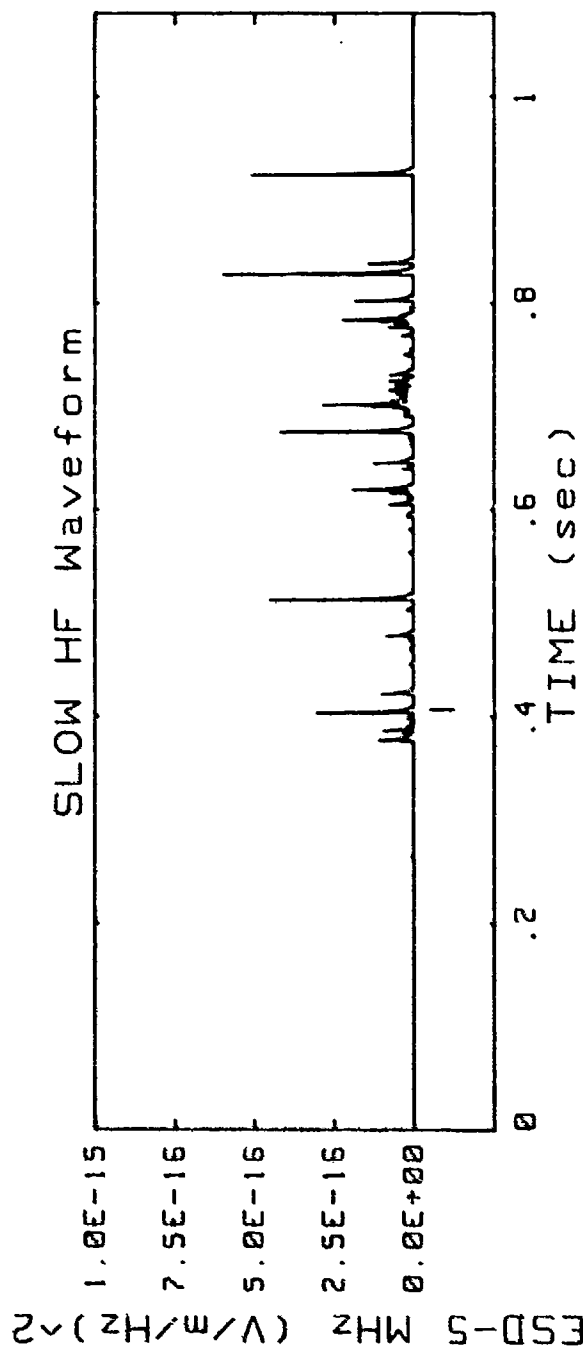
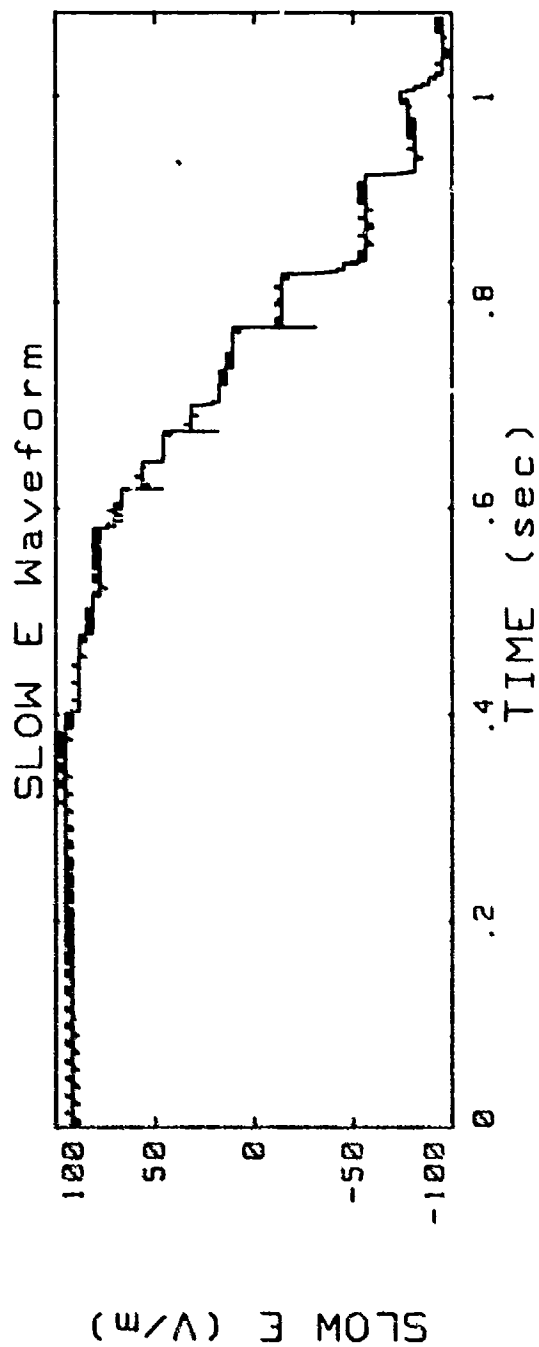


220203301.521 1985

1st RS (34.1 Km)

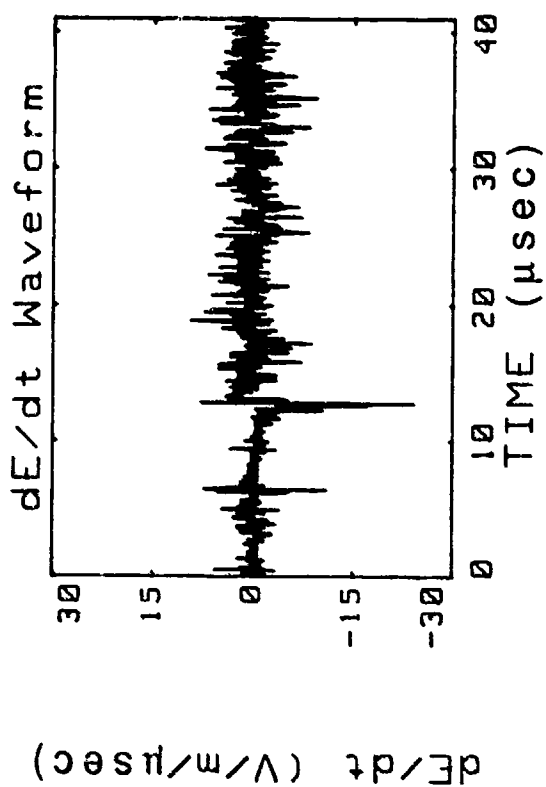
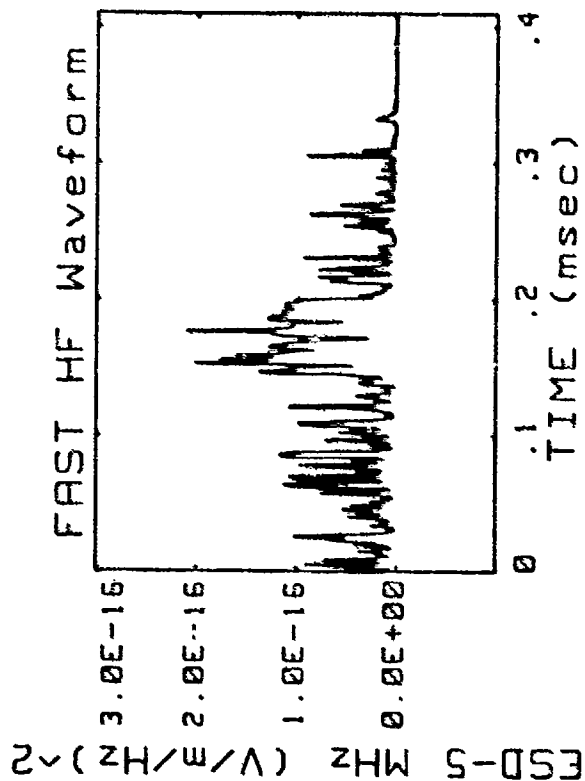
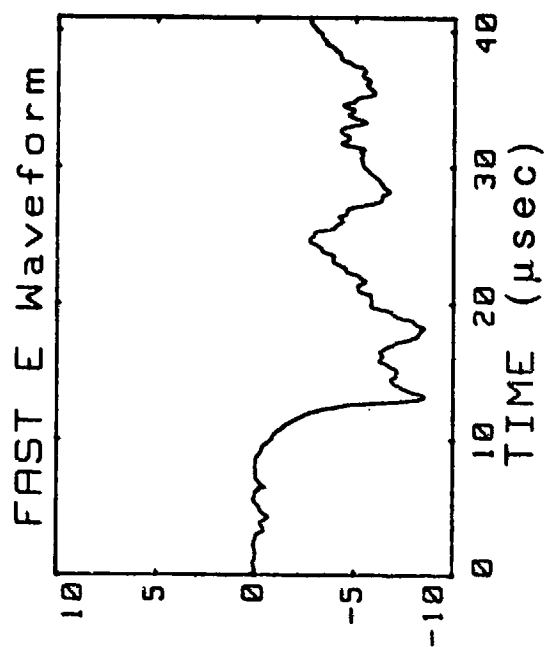
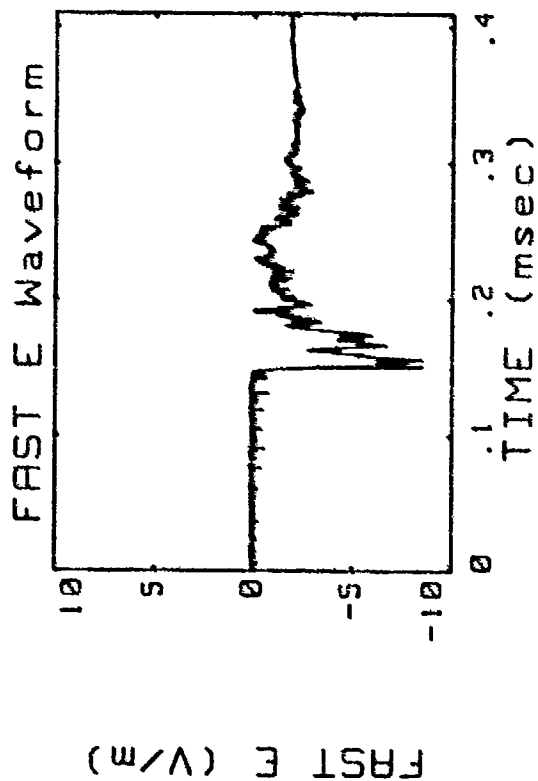


20:33:01.127 8 Aug 1985 (34.1 Km)

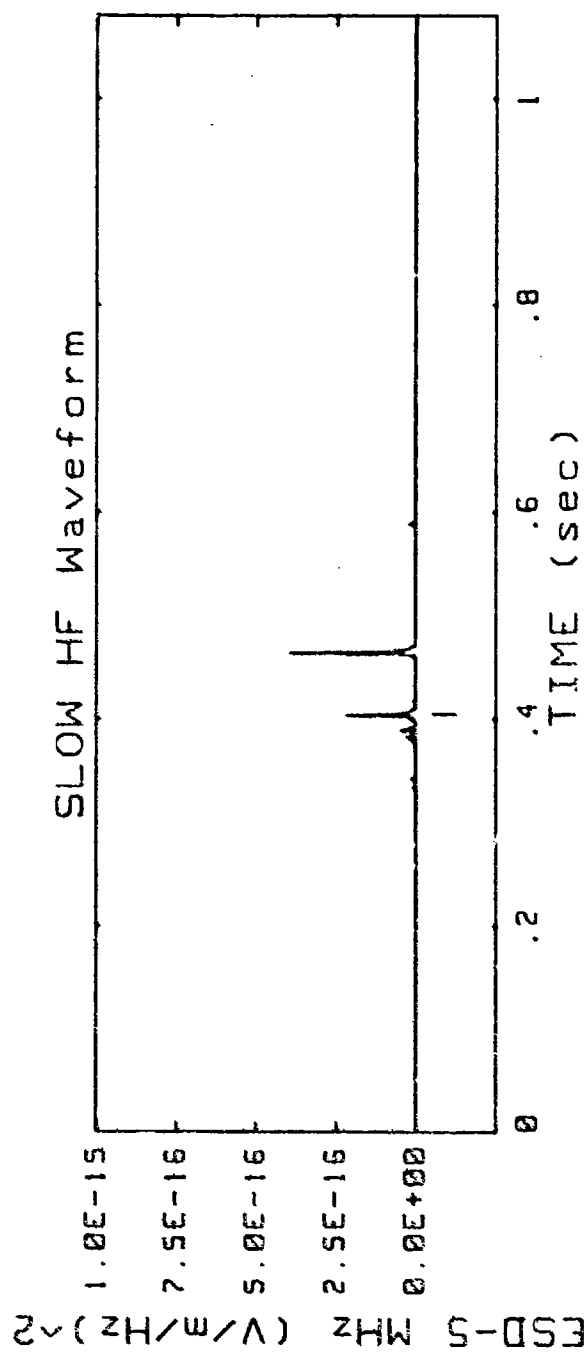
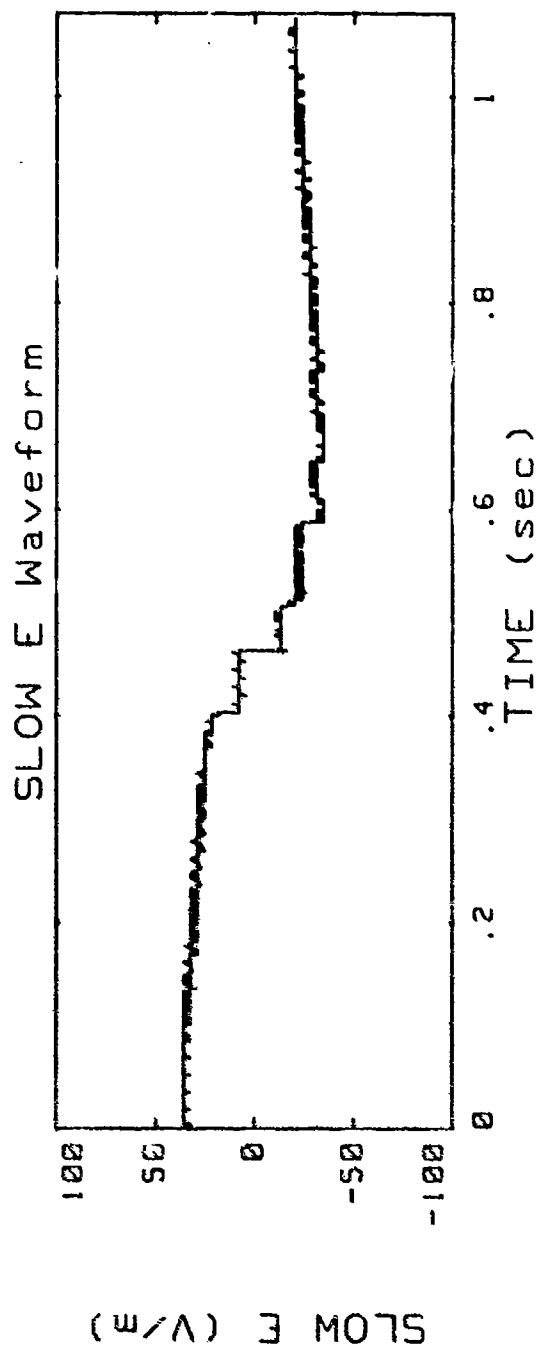


220203317.922 1985

1st RS (32.1 Km)

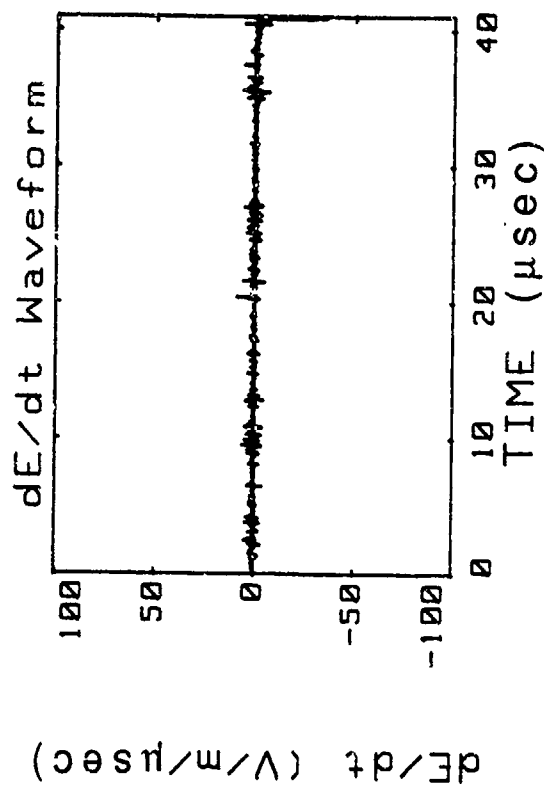
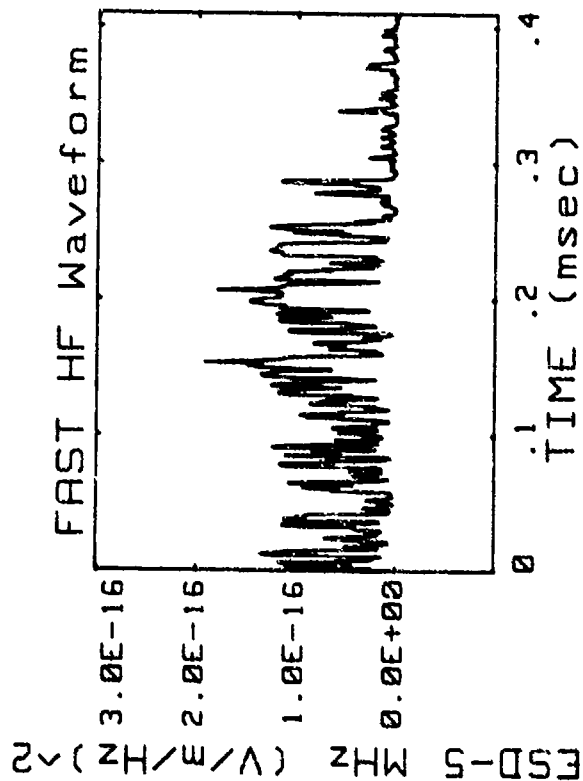
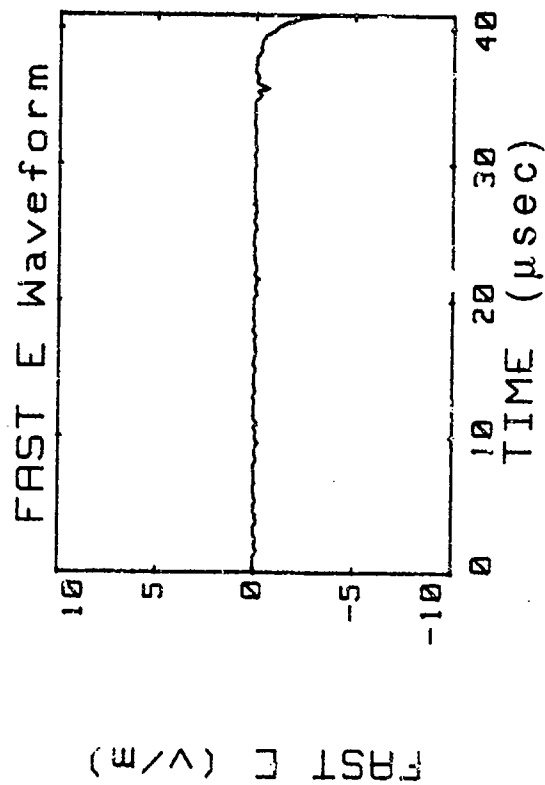
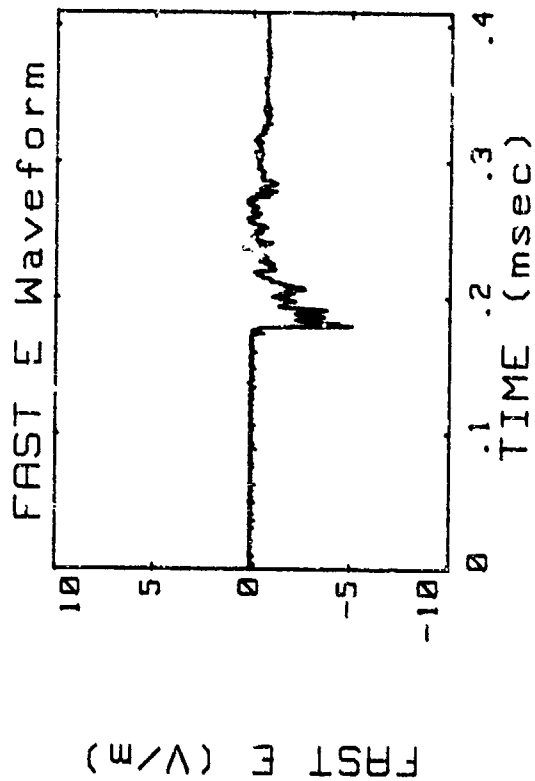


20:33:17.530 8 Aug 1985 (32.1 Km)

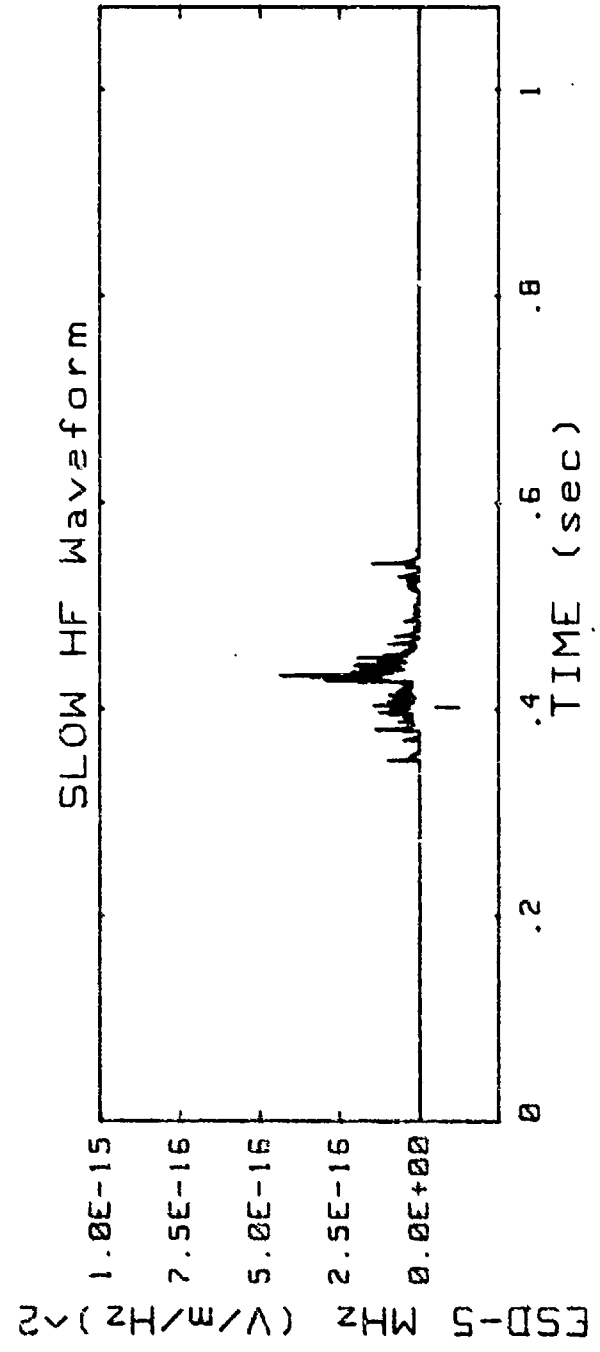
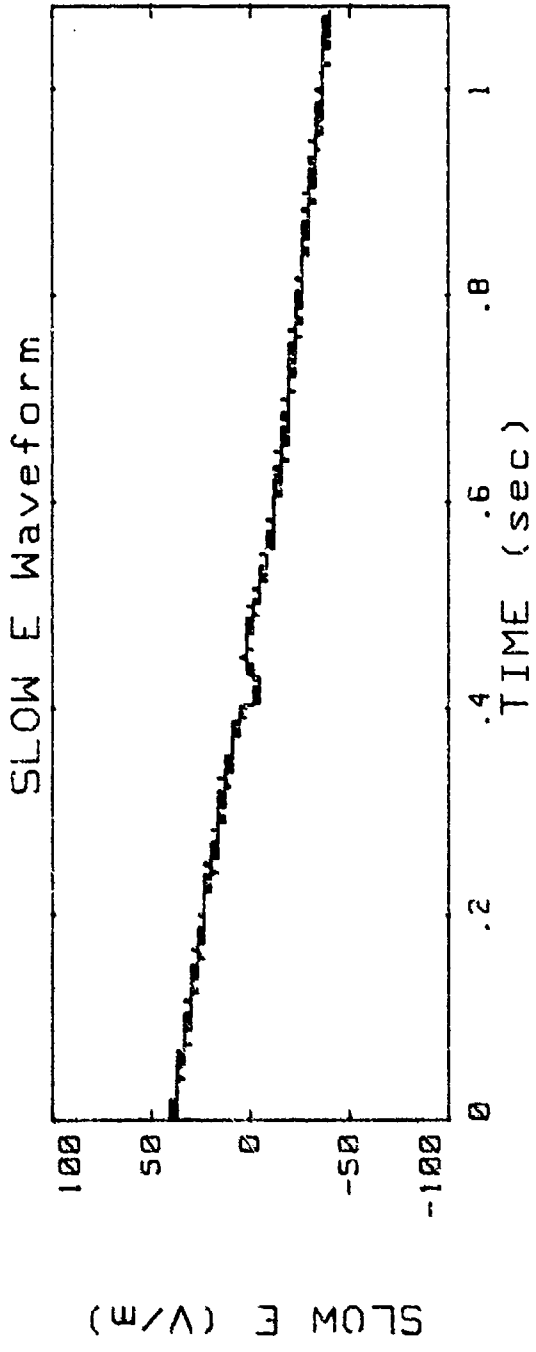


220203338.829 1985

Stepped Leader (33.3 Km)

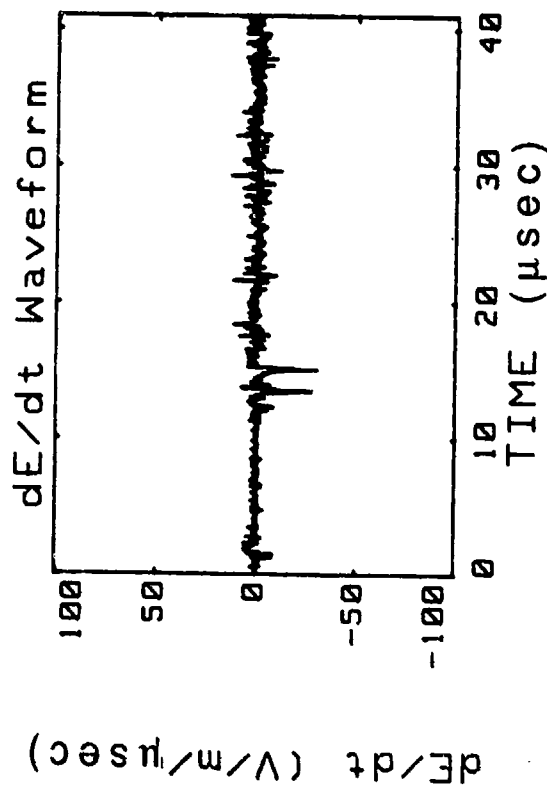
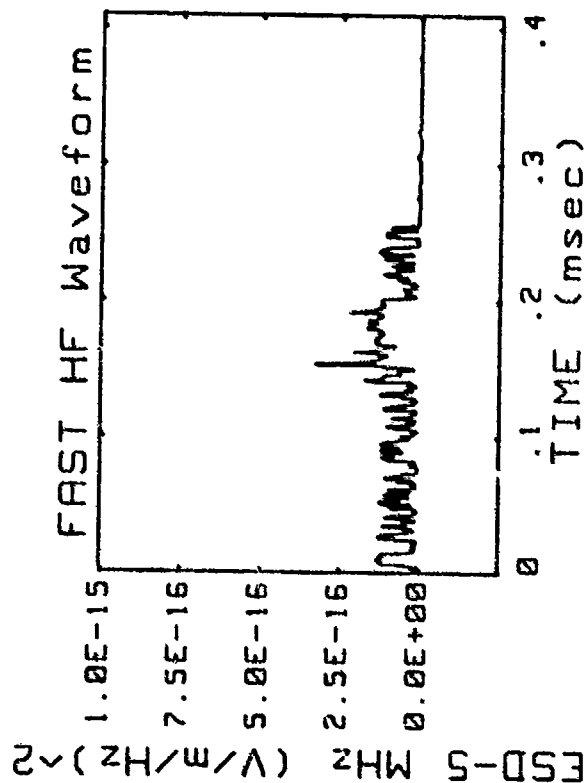
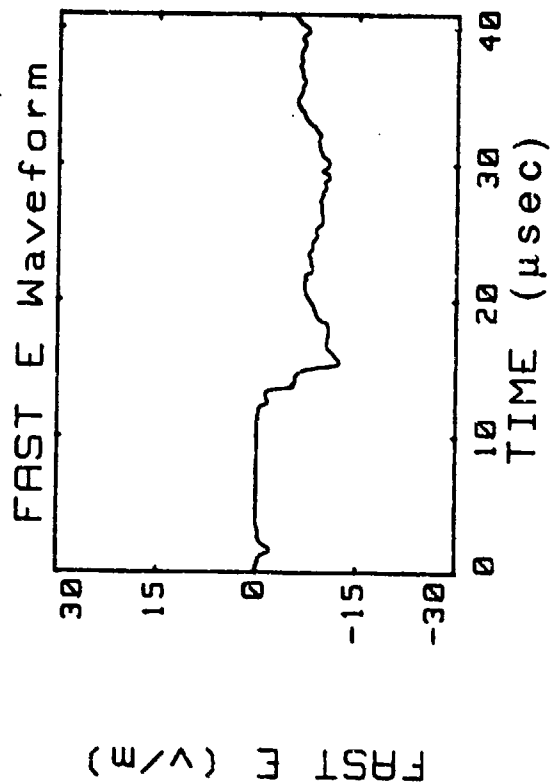
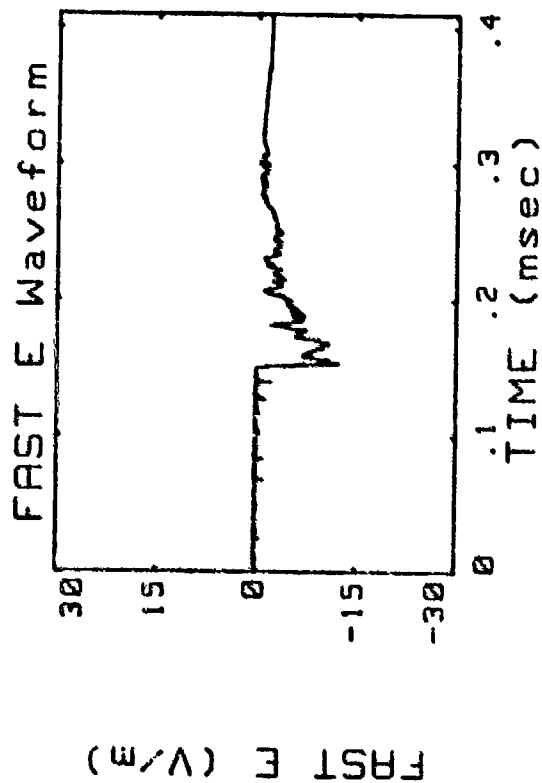


20:33:38.440 8 Aug 1985 (33.3 Km)



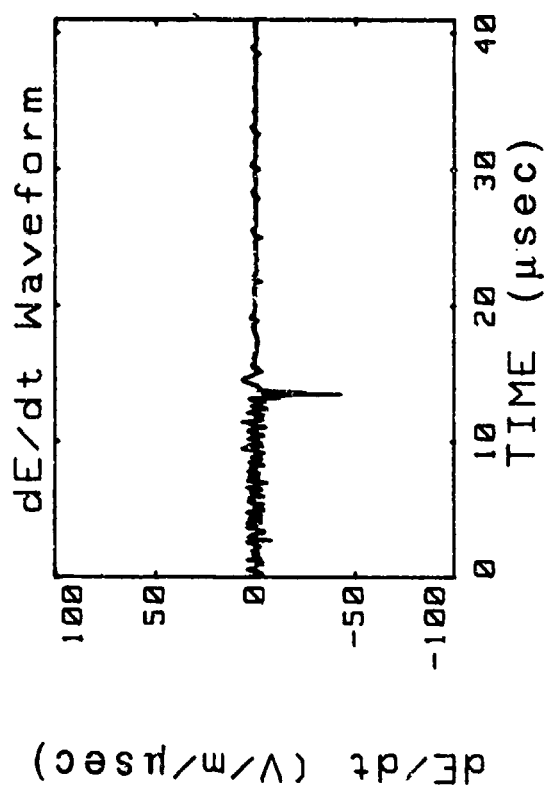
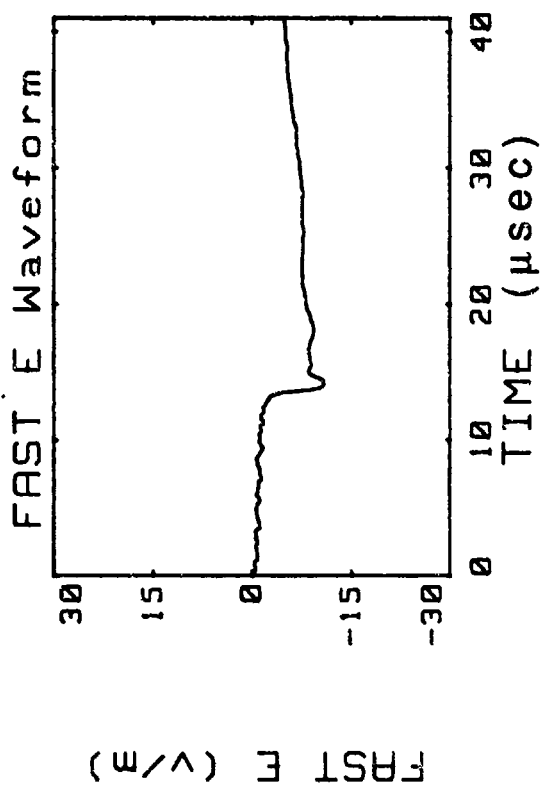
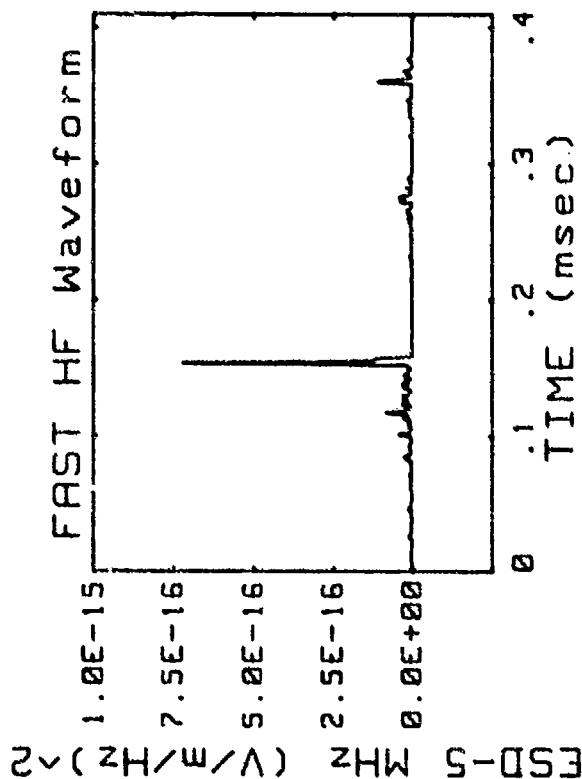
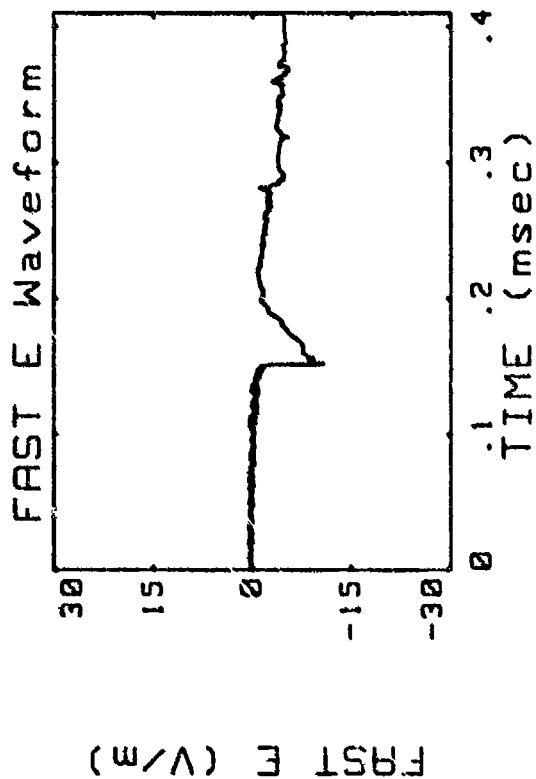
220203446.983 1985

1st RS (33.2 Km)

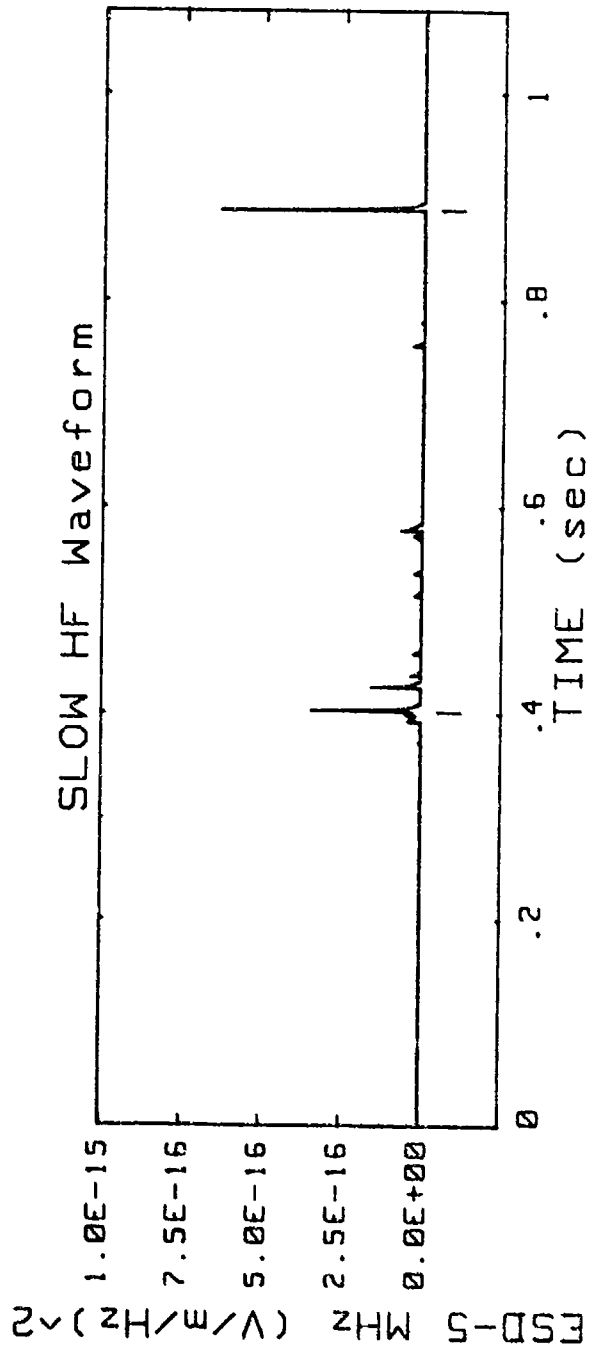
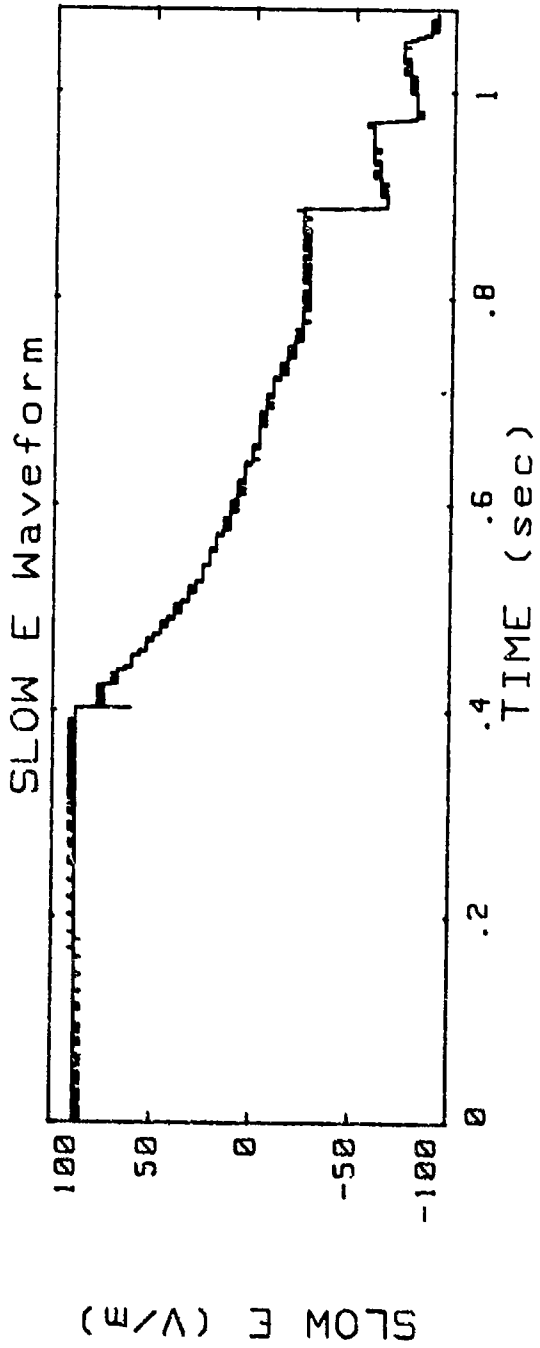


220203447.469 1985

Chaotic Subs RS (33.2 Km)

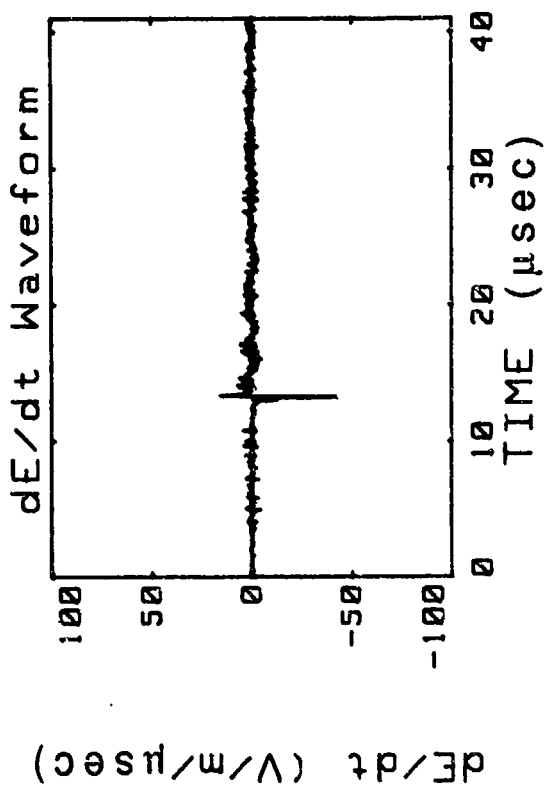
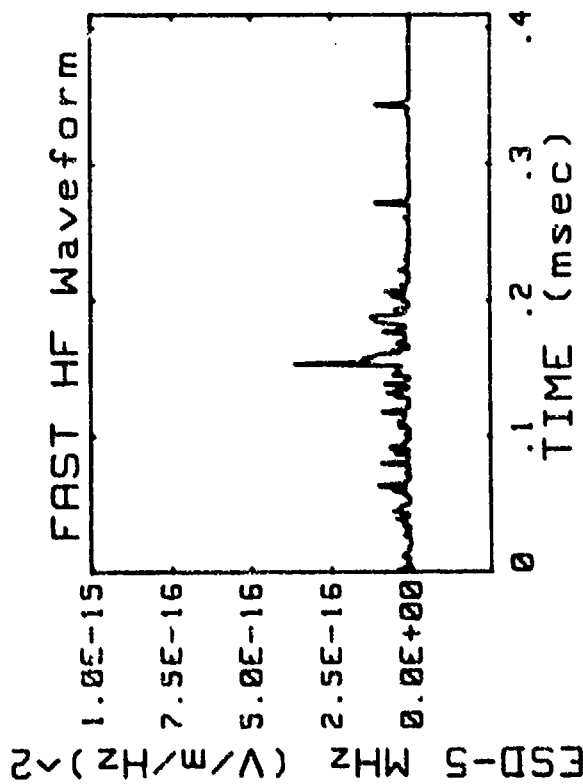
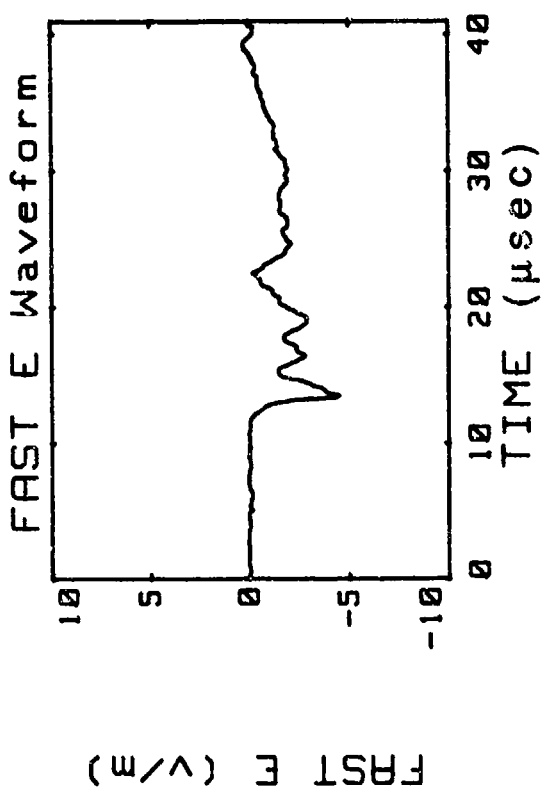
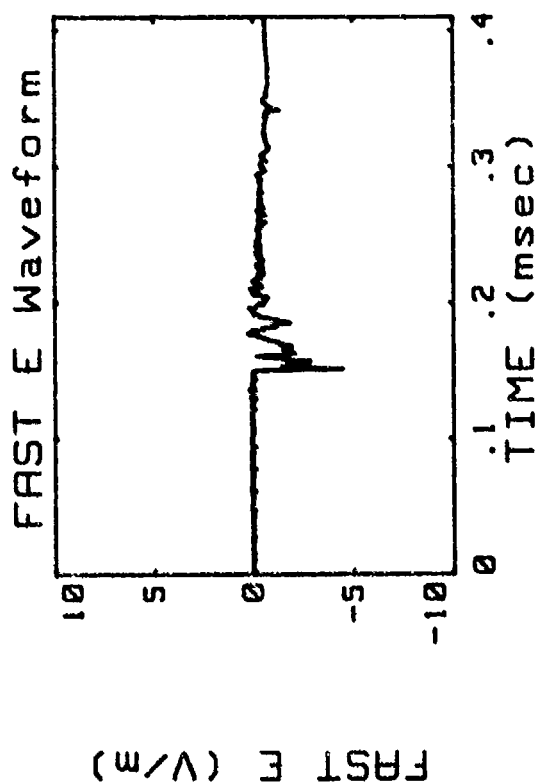


20:34:46.594 8 Aug 1985 (33.2 Km)

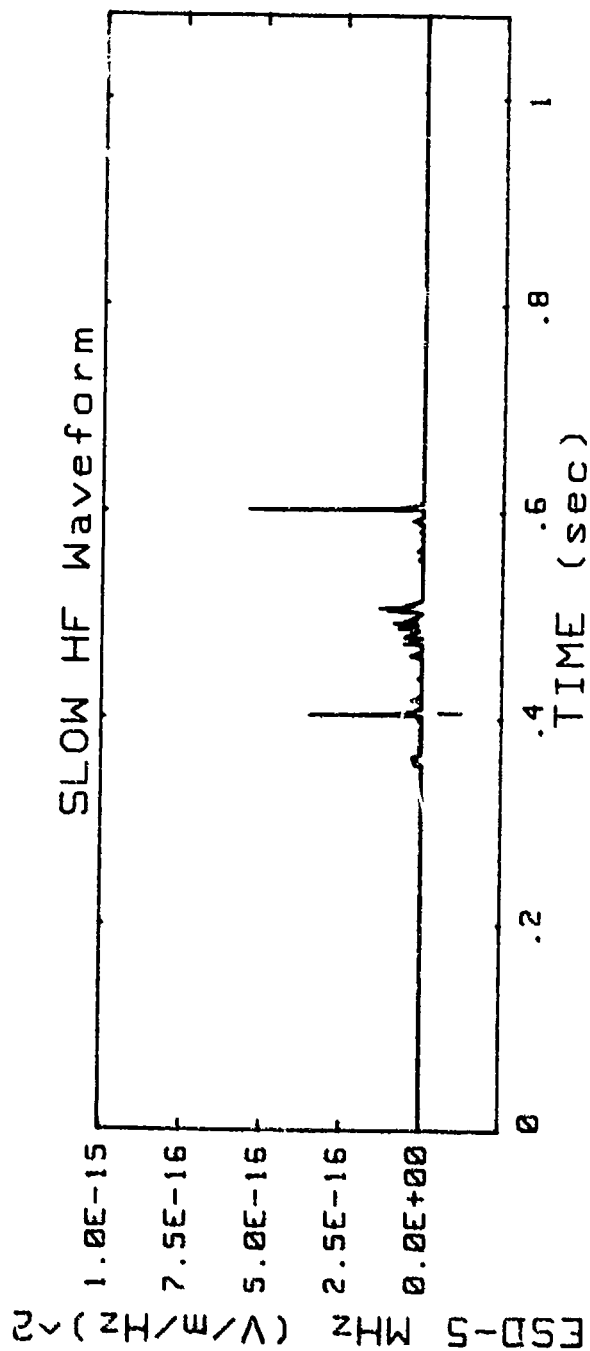
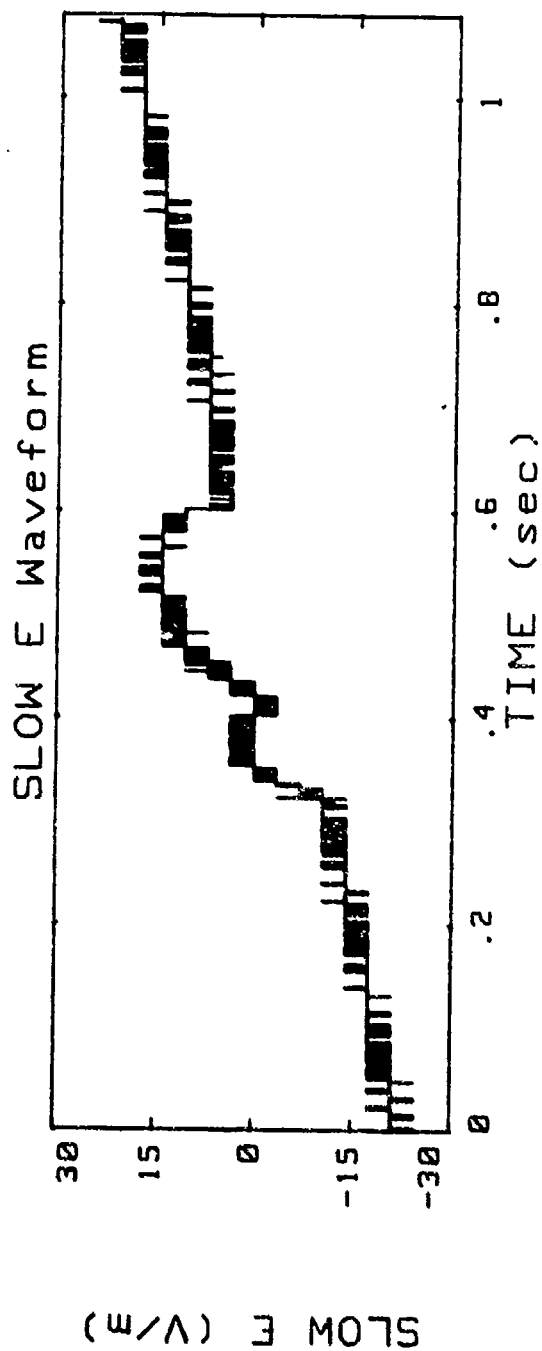


220203454.147 1985

1st RS (33.1 Km)

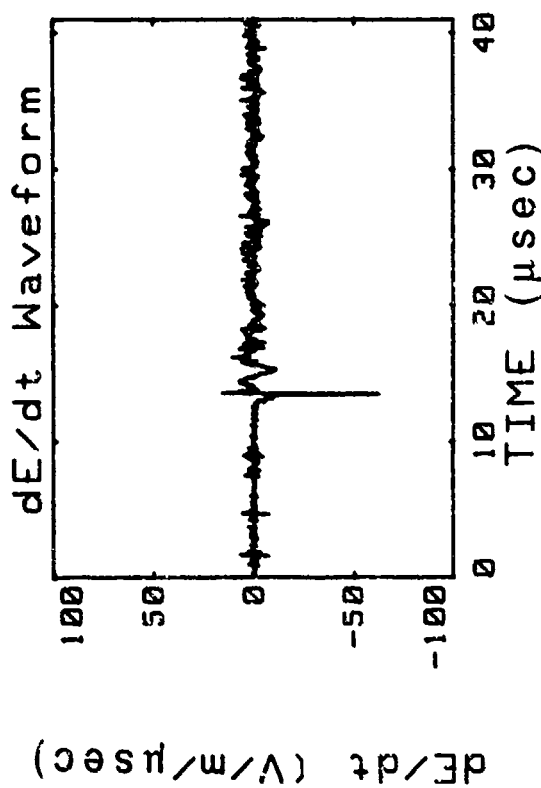
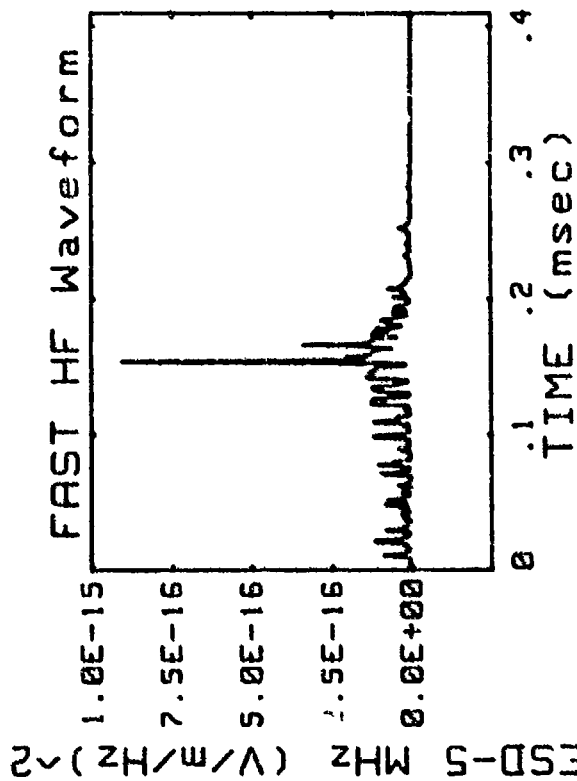
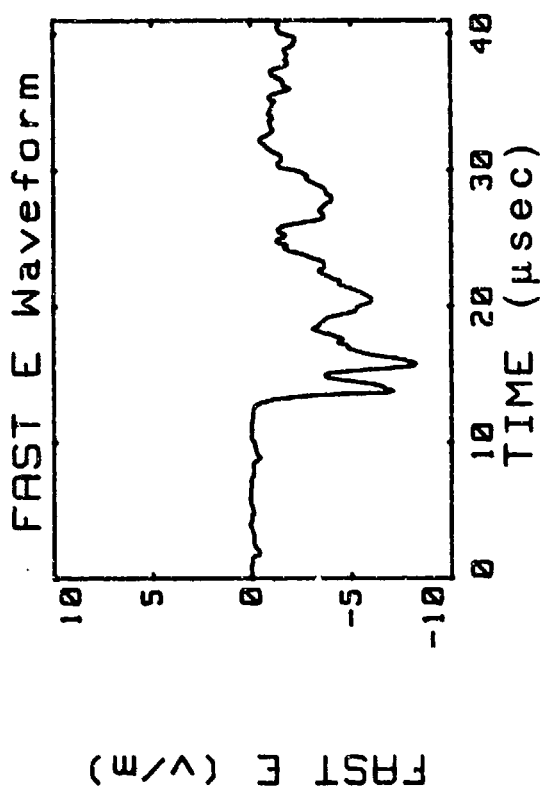
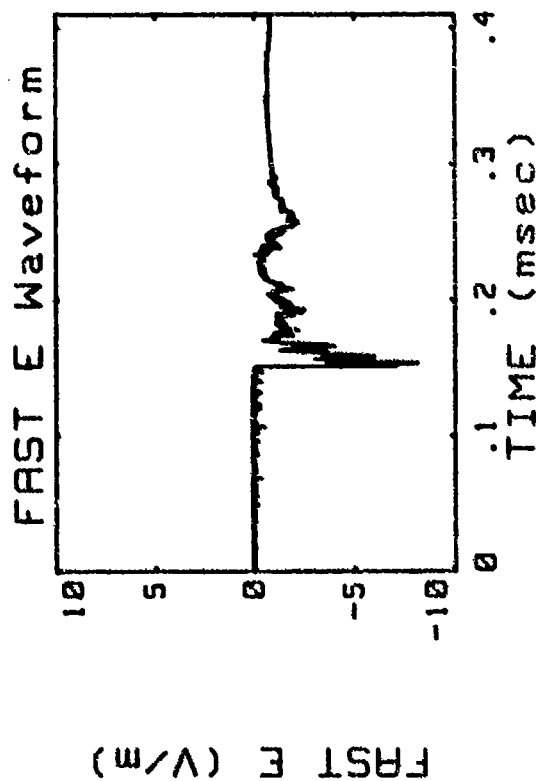


20:34:53.75 8 Aug 1985 (33.1 Km)



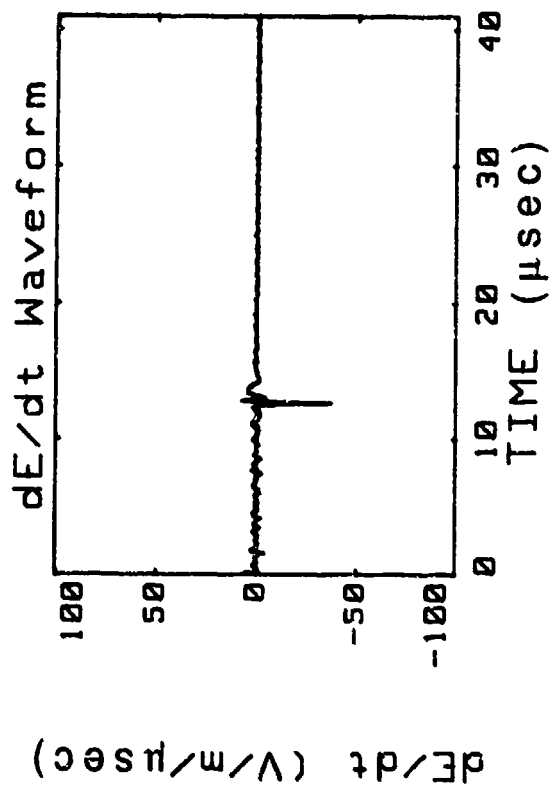
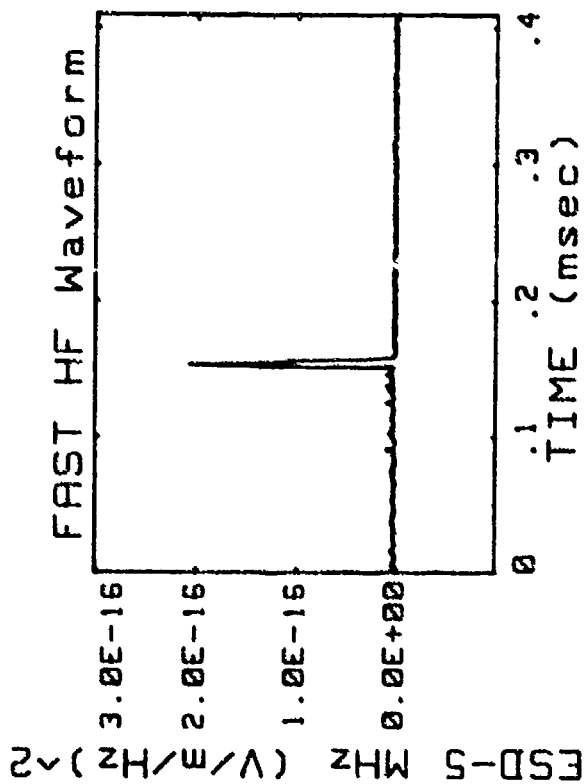
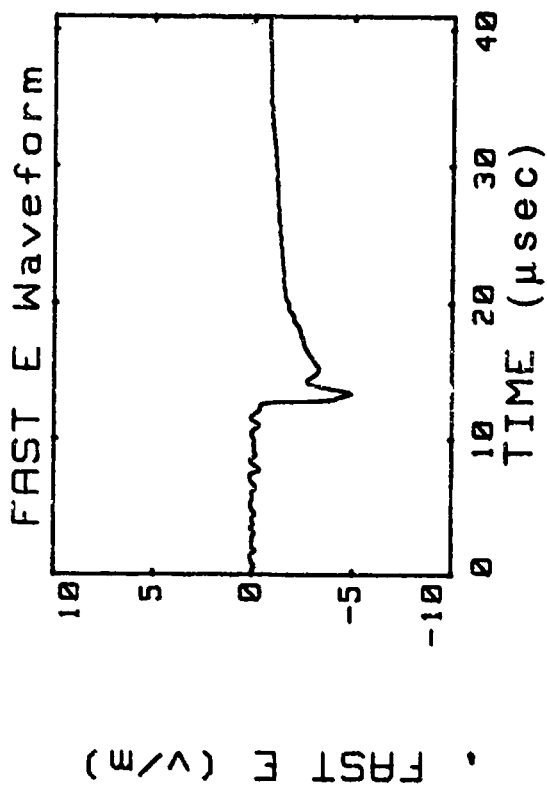
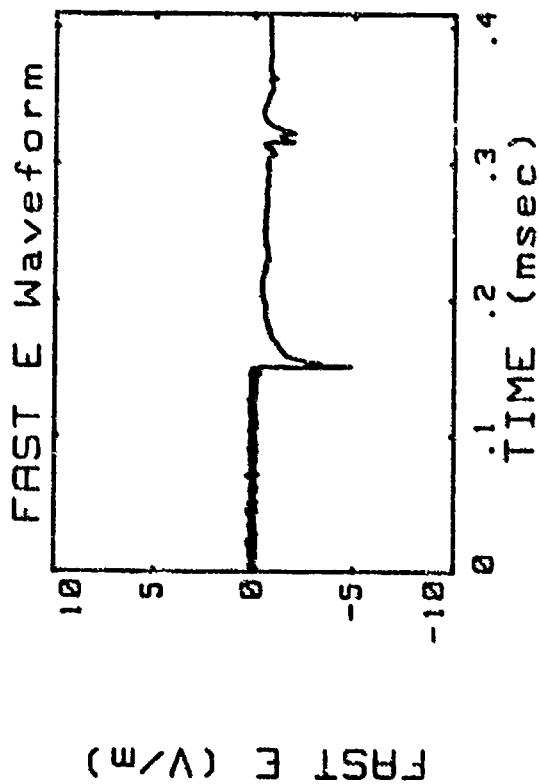
220203530.392 1985

1st RS (33.8 Km)

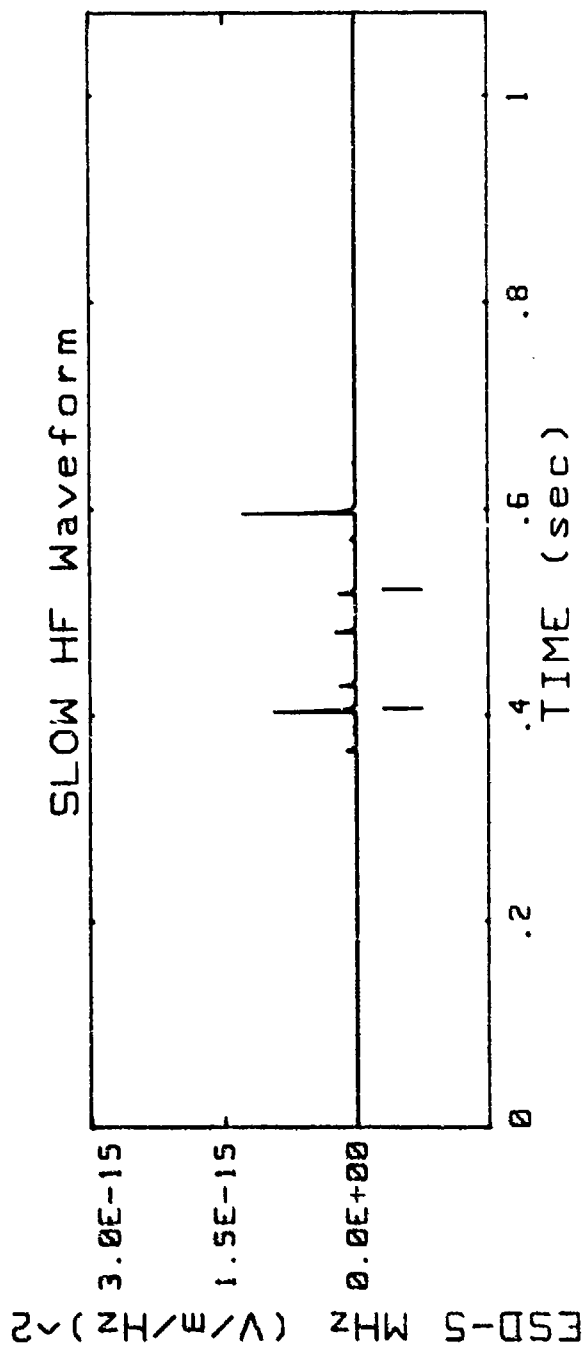
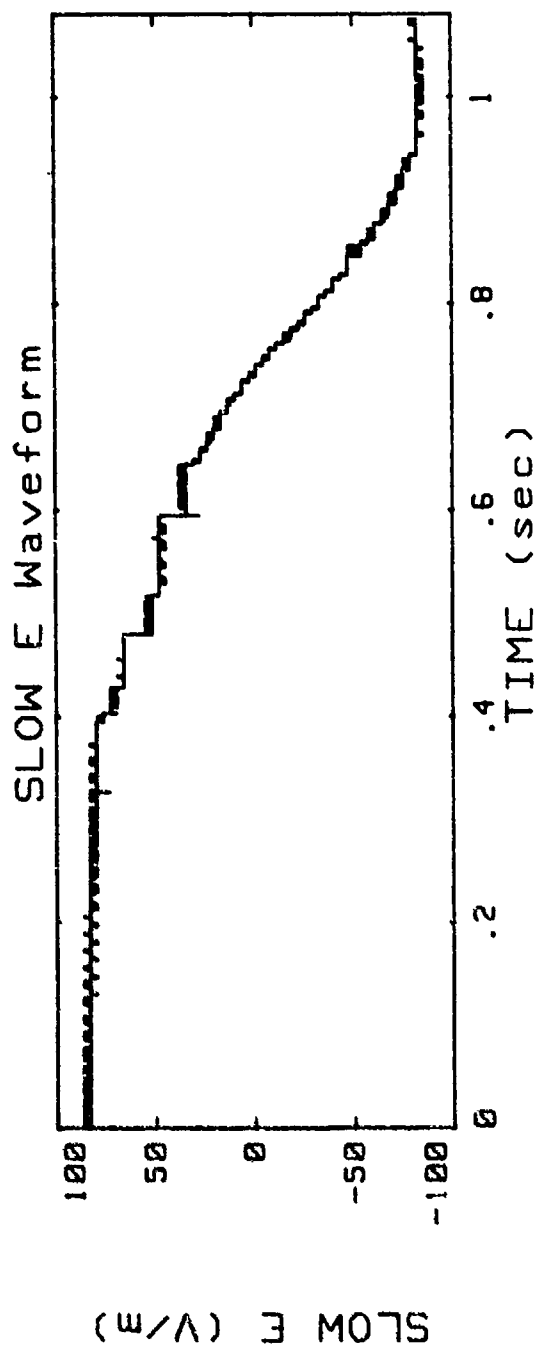


220203530.508 1985

Norm Subs RS (33.8 Km)

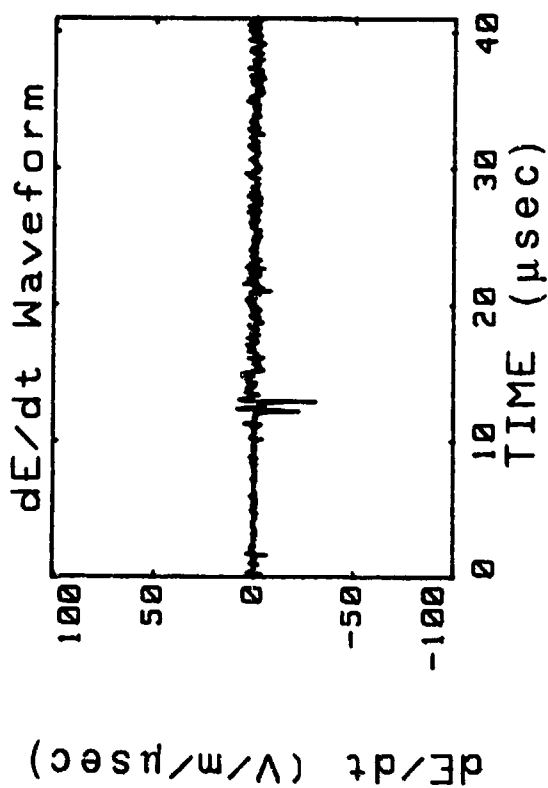
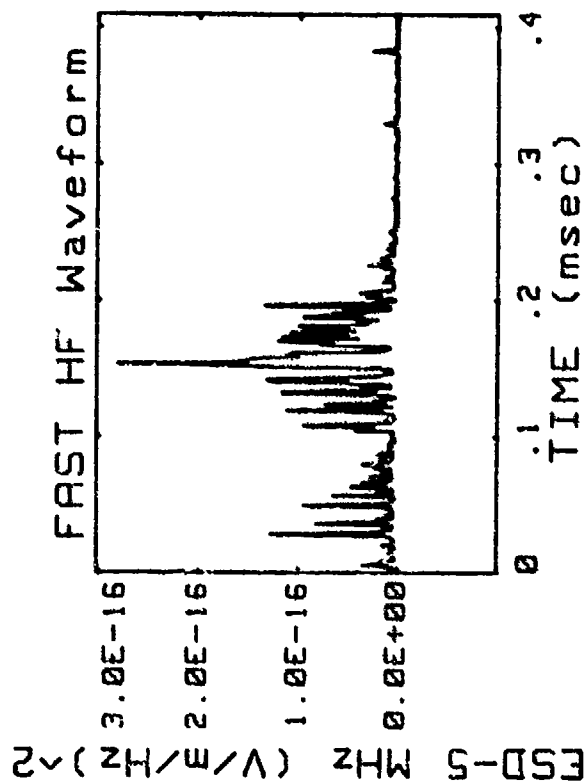
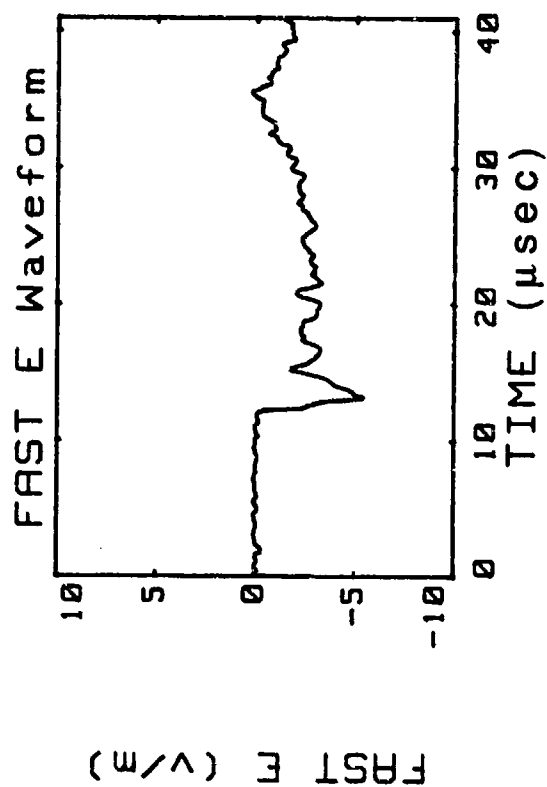
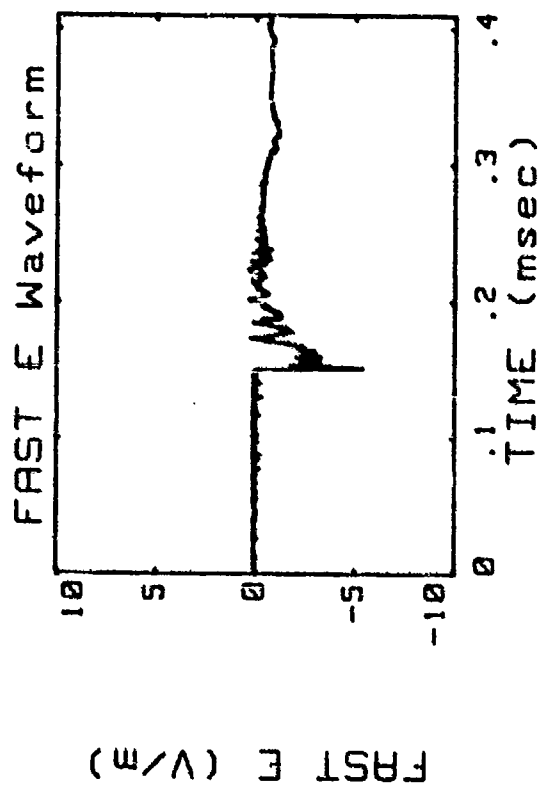


20:35:29.998 8 Aug 1985 (33.8 Km)

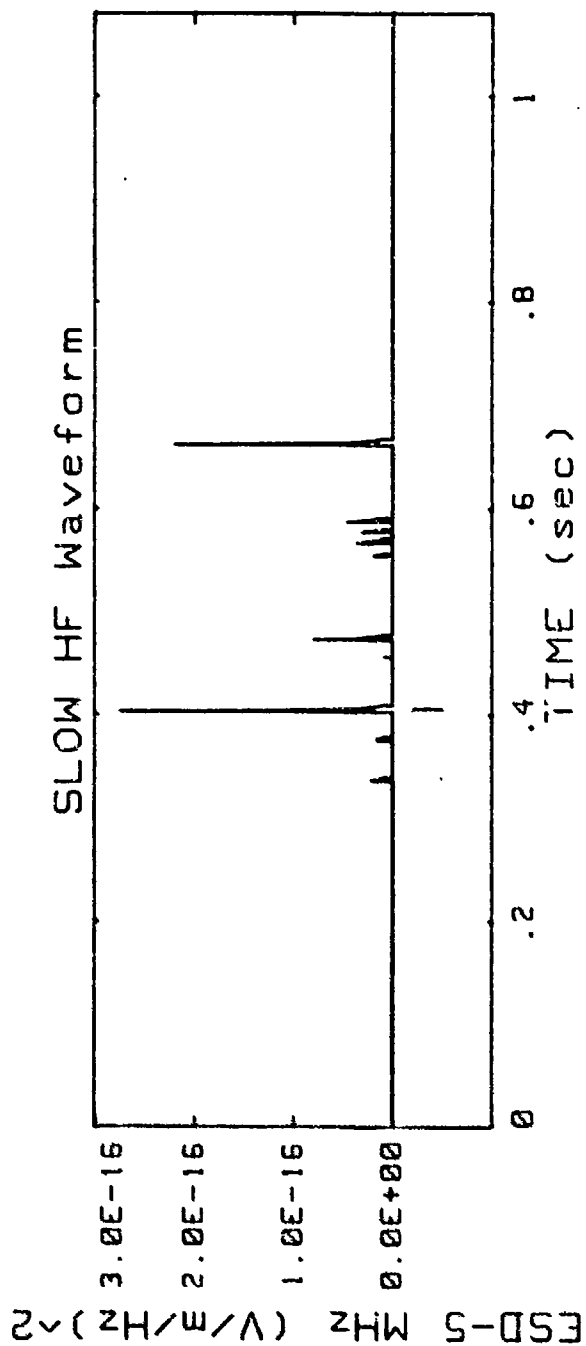
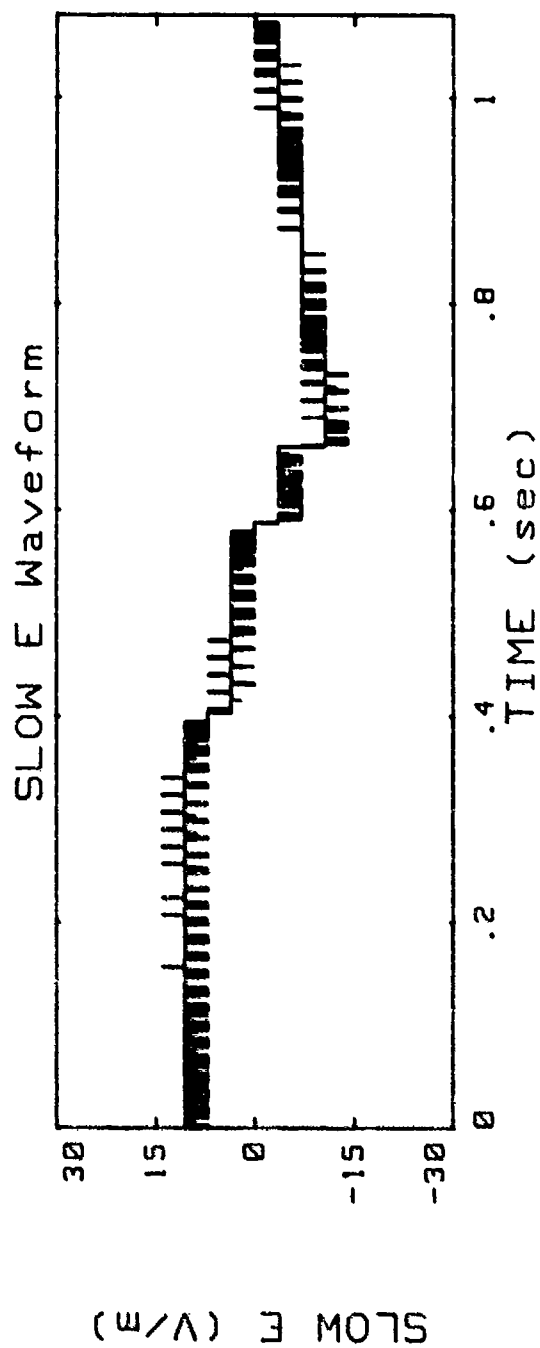


220203550.274 1985

1st RS (36.6 Km)

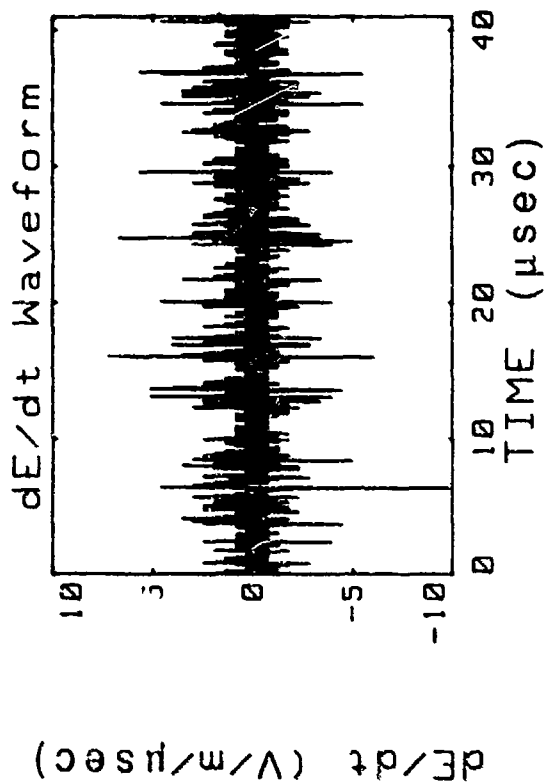
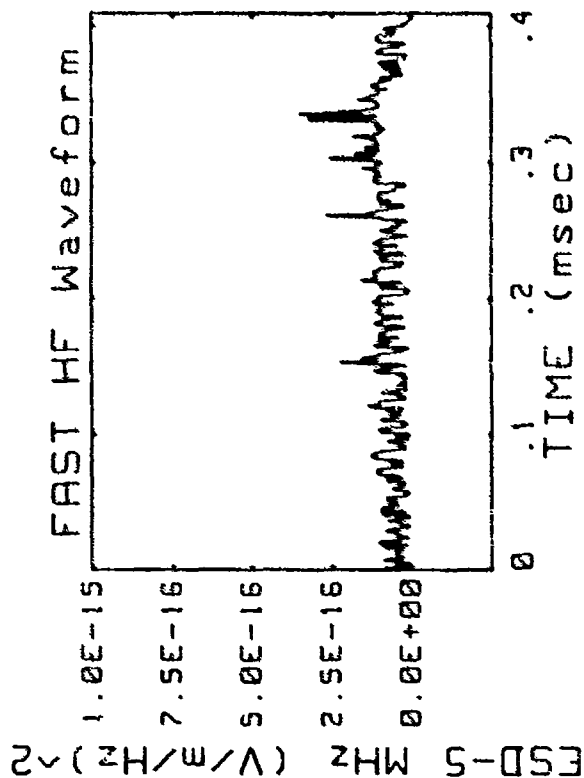
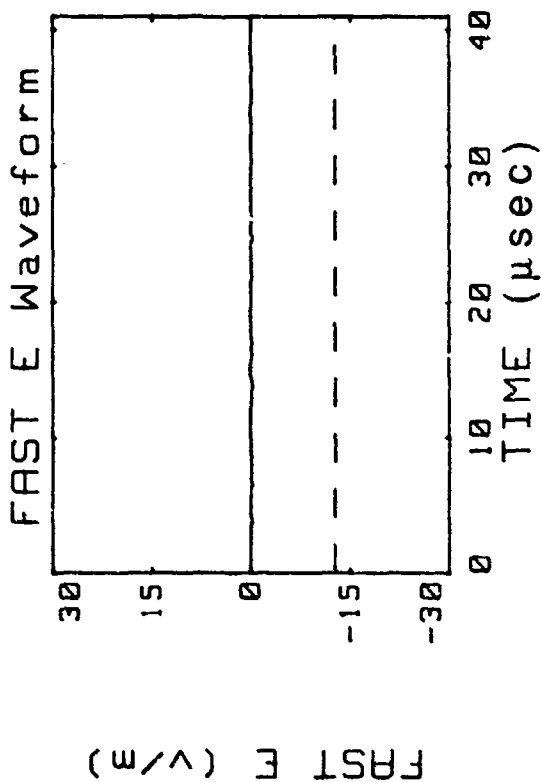
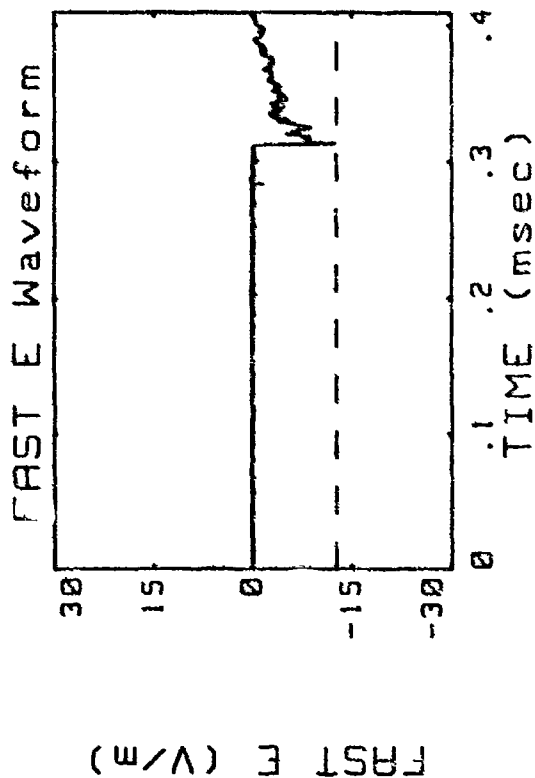


20:35:49.881 8 Aug 1985 (36.6 Km)

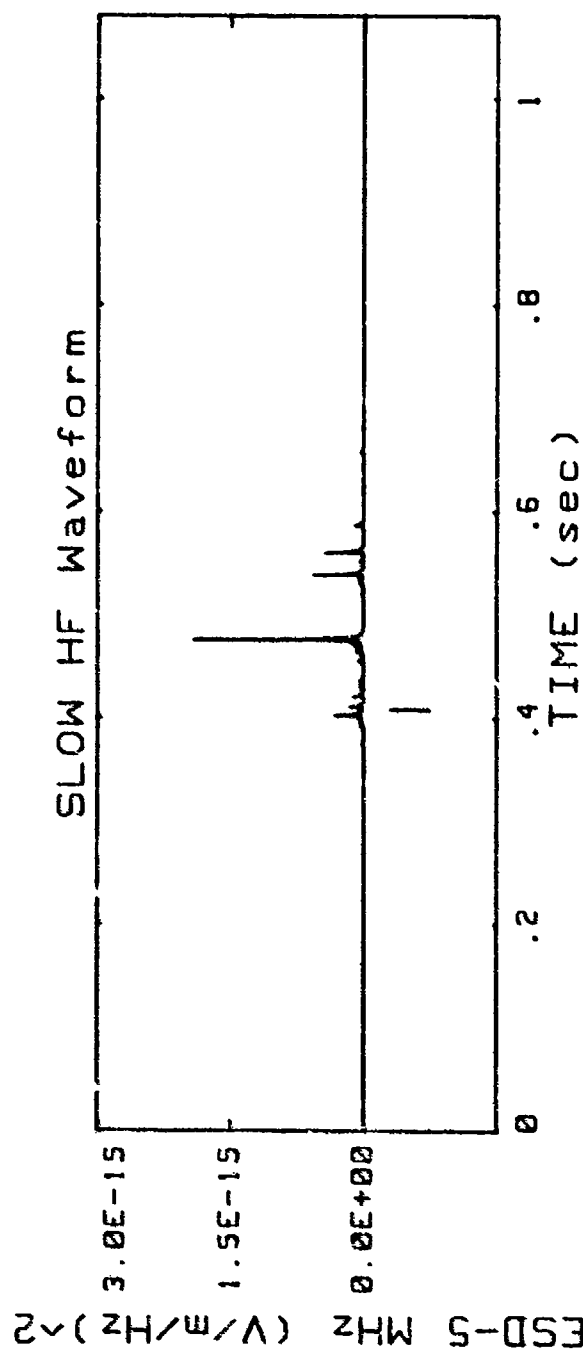
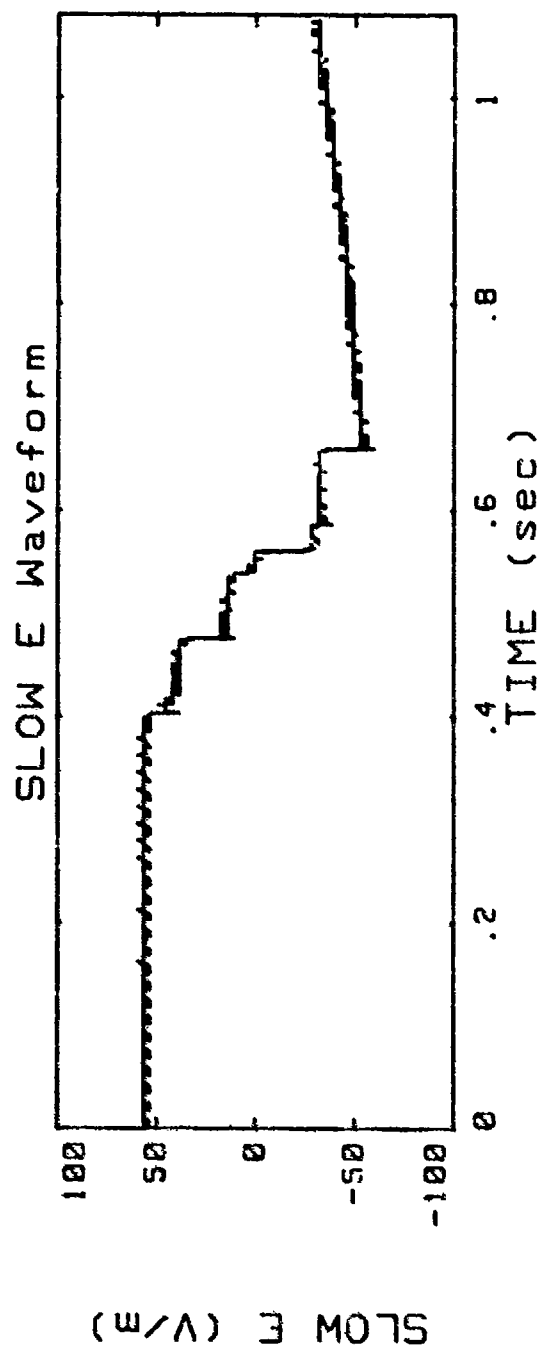


220203658.283 1985

Stepped Leader (31.5 Km)

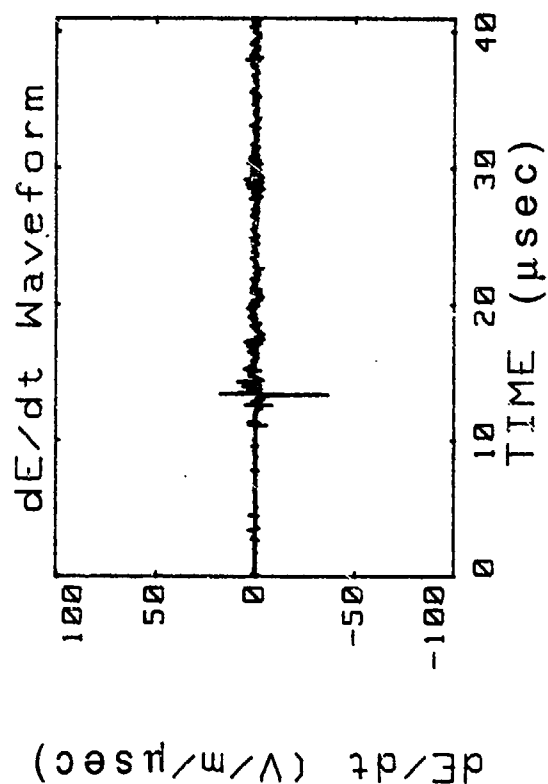
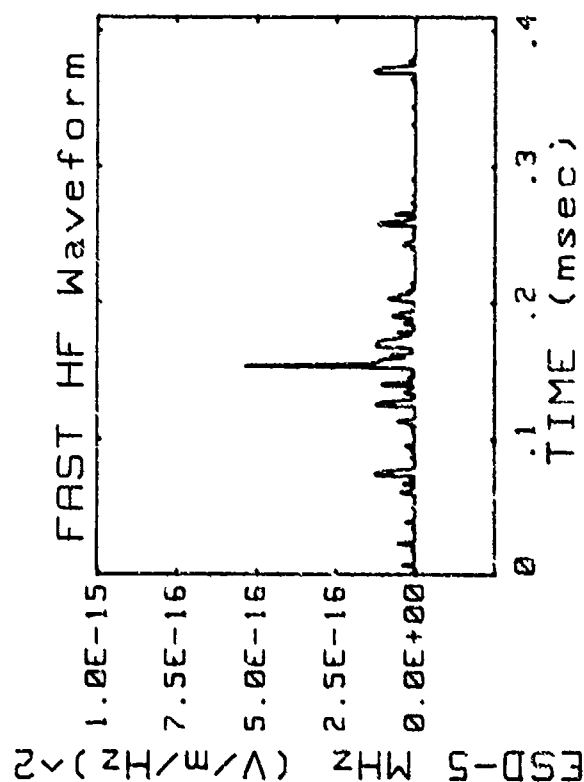
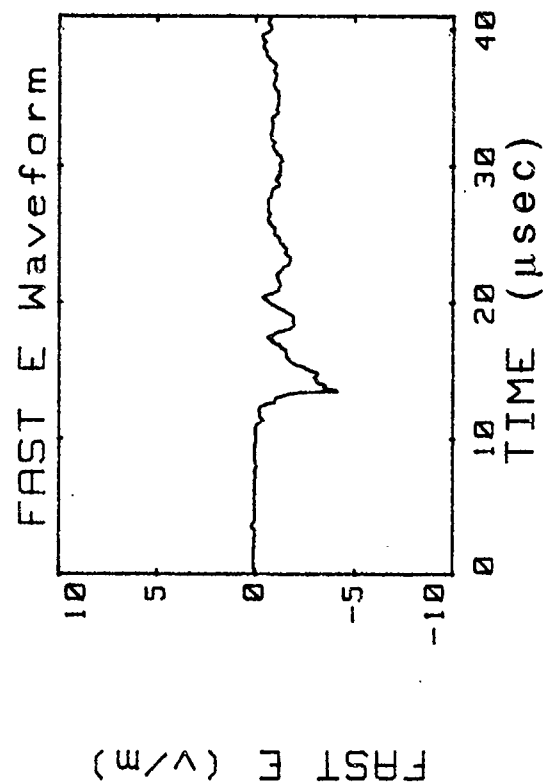
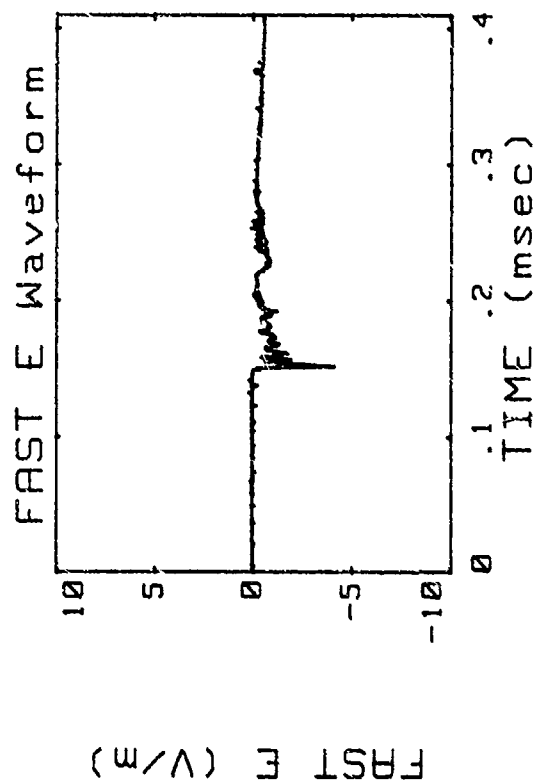


20:36:57.887 8 Aug 1985 (31.5 Km)

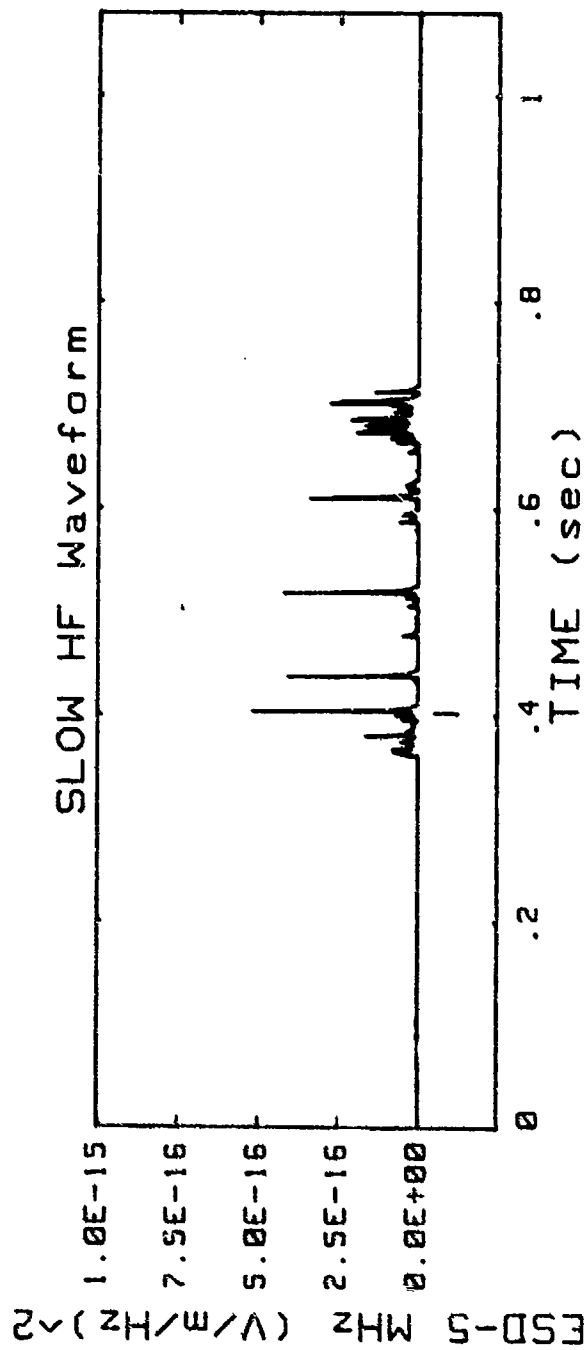
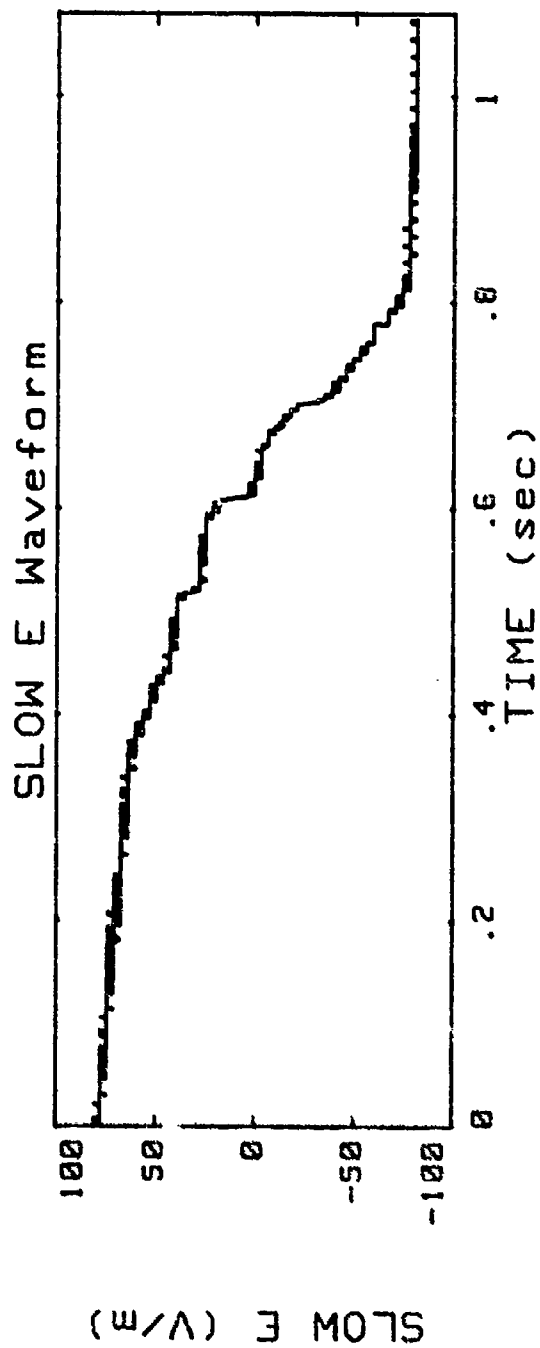


220203717.020 1985

1st RS (32.2 Km)

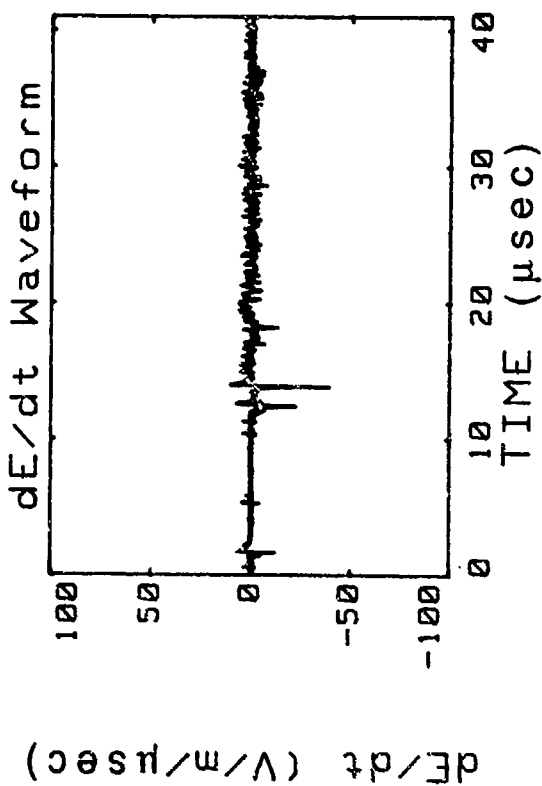
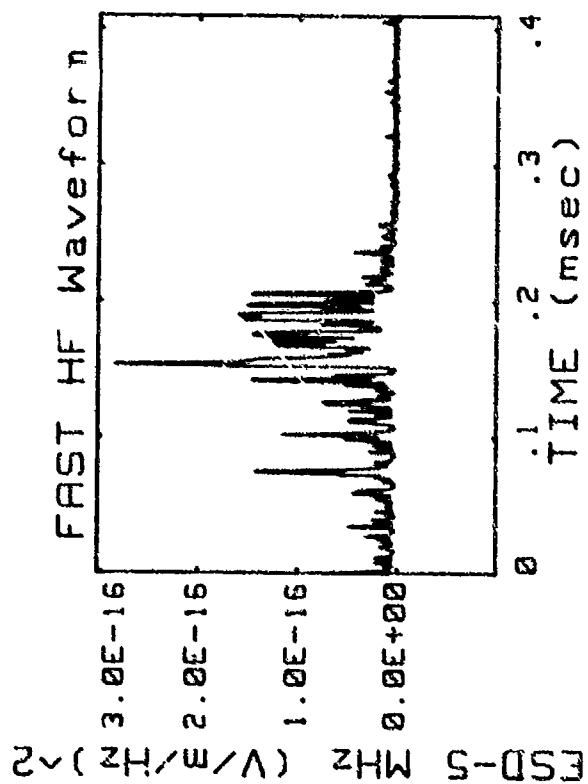
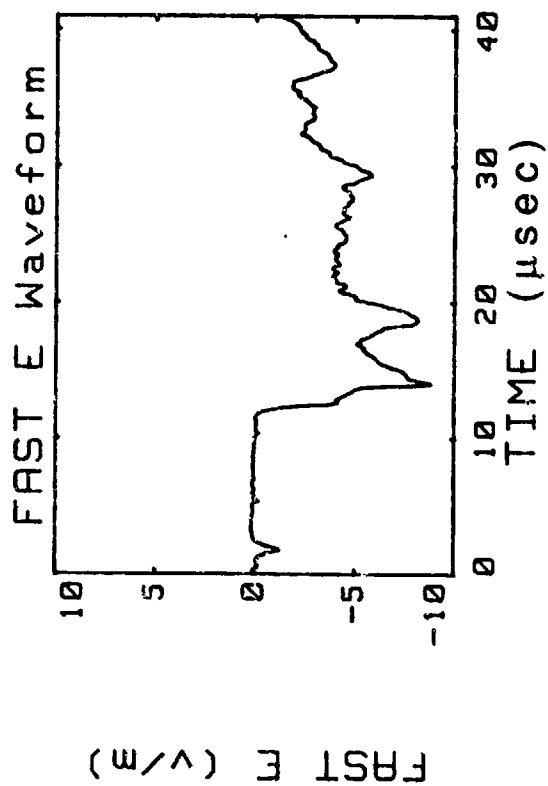
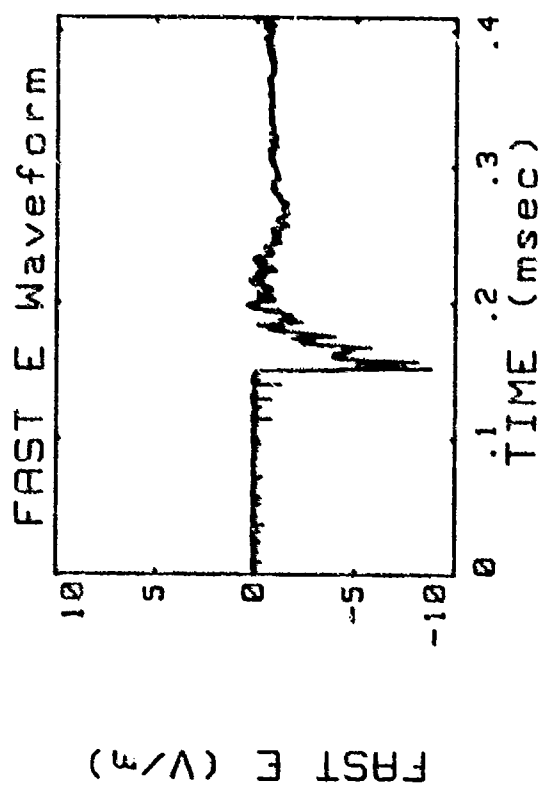


20:37:16.631 8 Aug 1985 (32.2 Km)

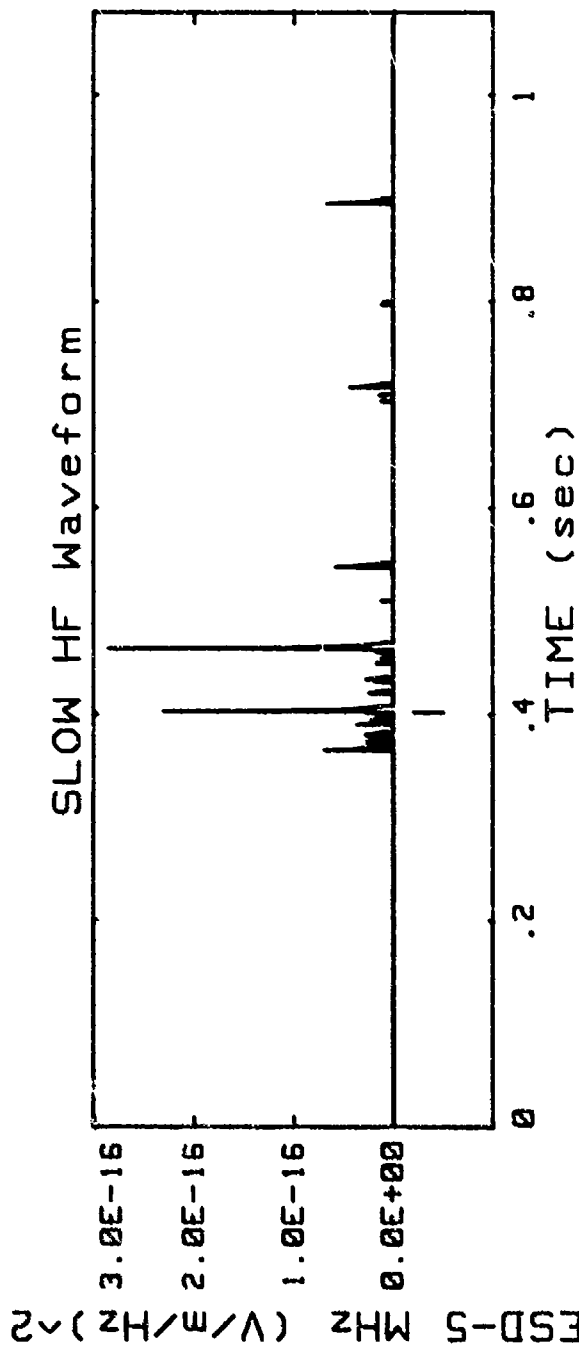
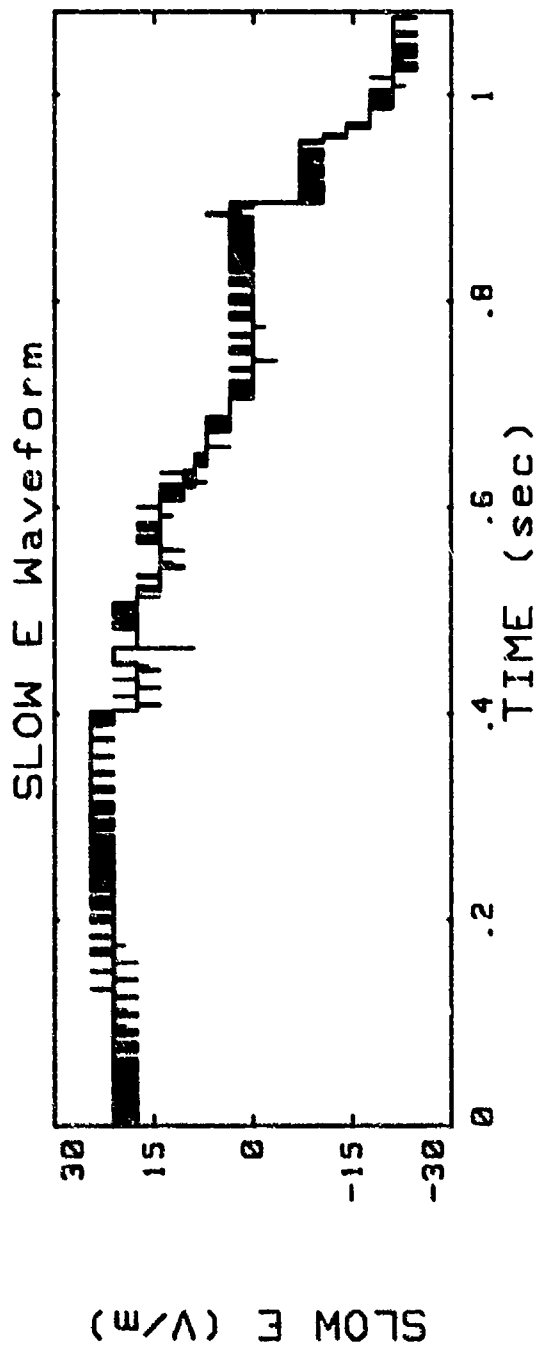


220203738.206 1985

1st RS (37.3 Km)

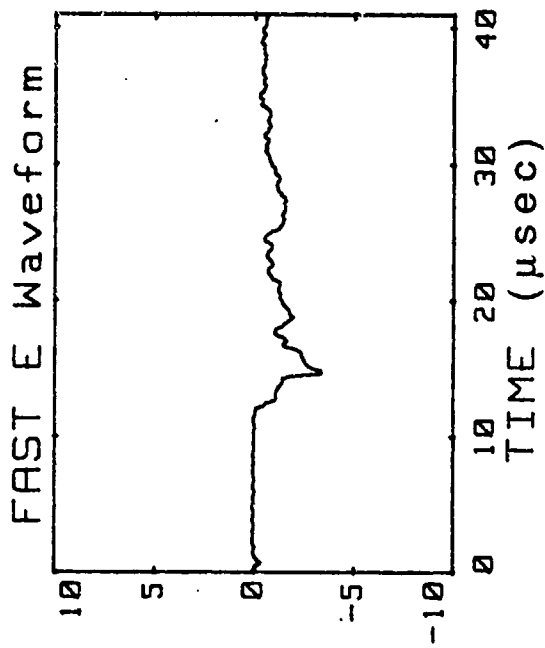
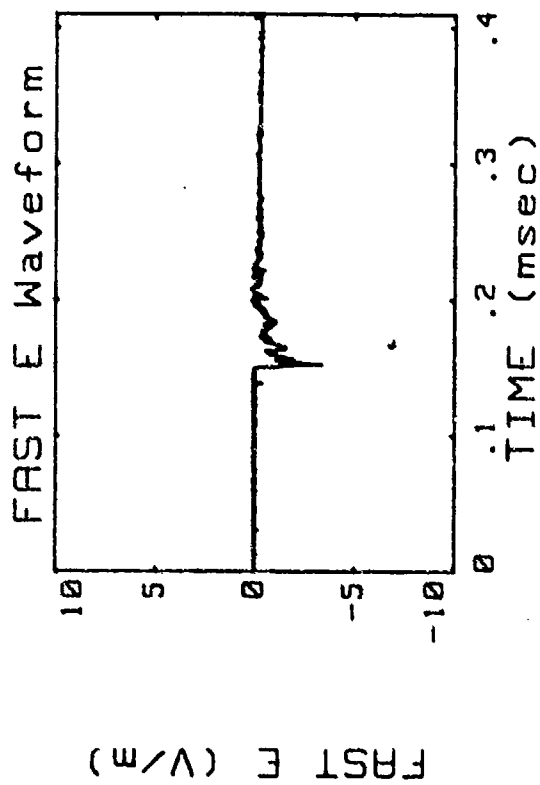


20:37:37.816 8 Aug 1985 (37.3 Km)

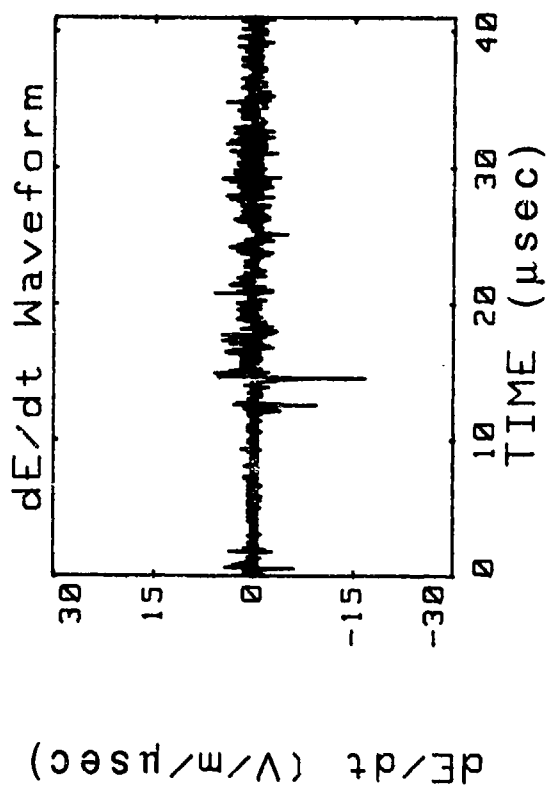
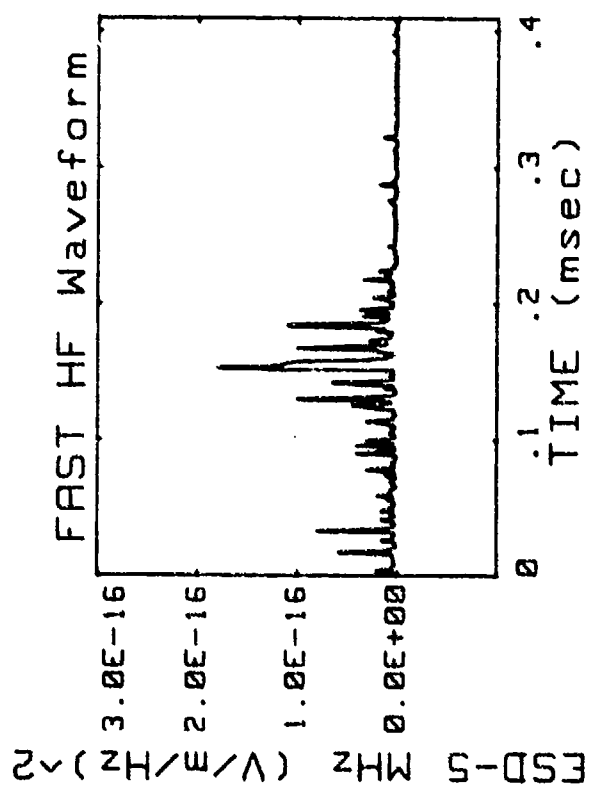


220204239.449 1985

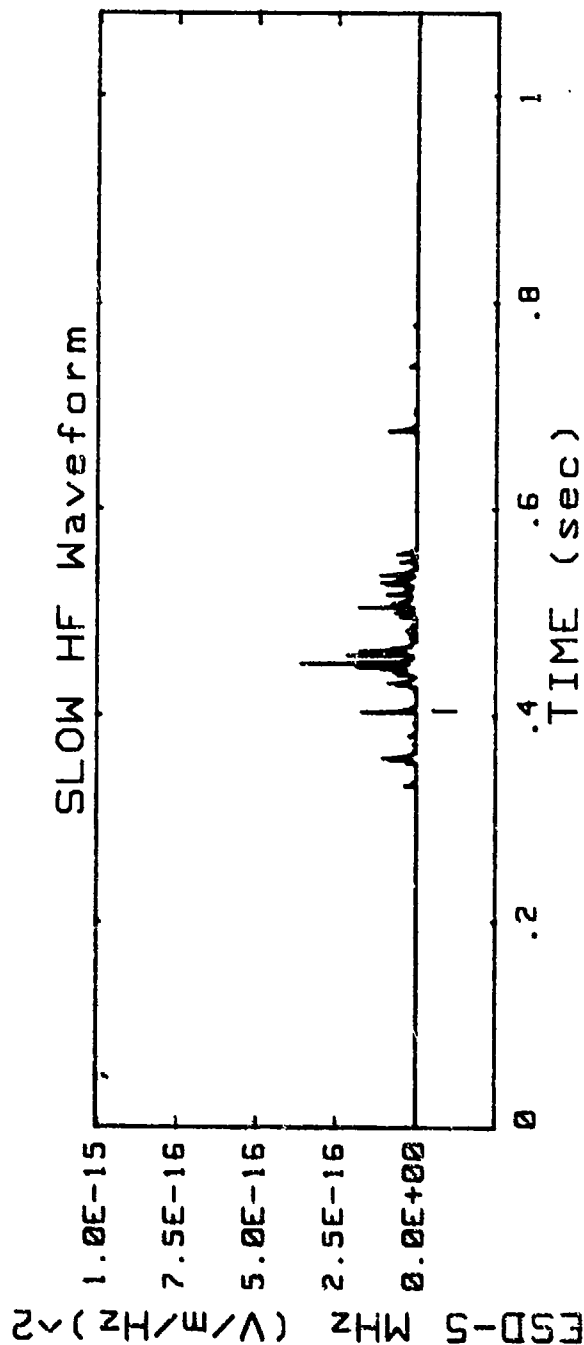
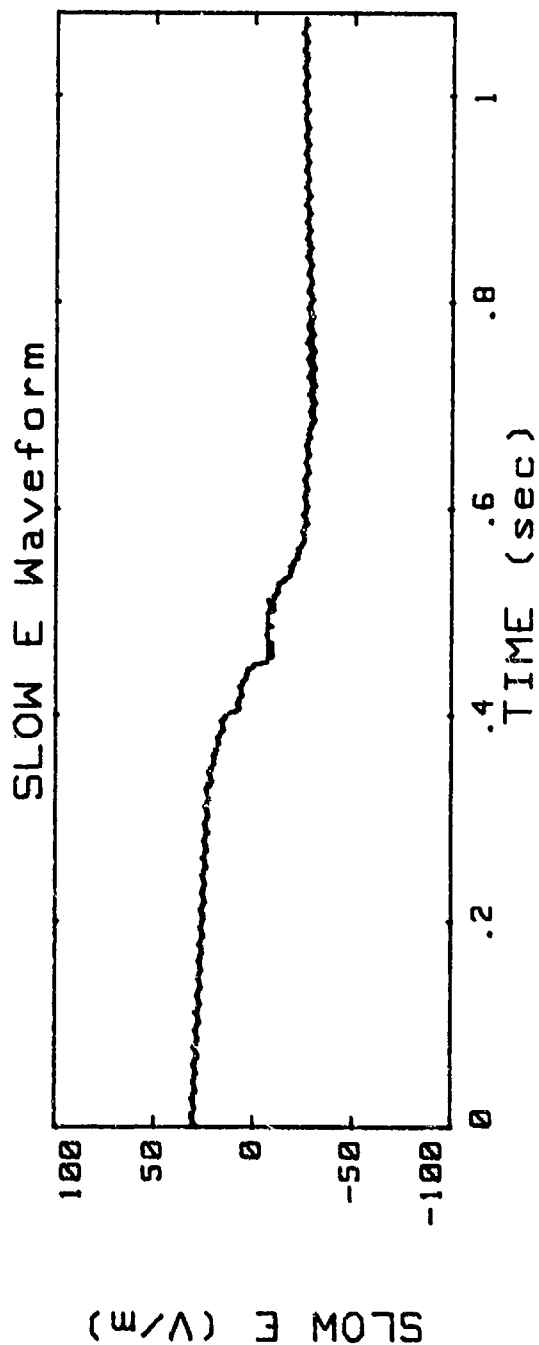
1st RS (32.8 Km)



FRST E (V/m)

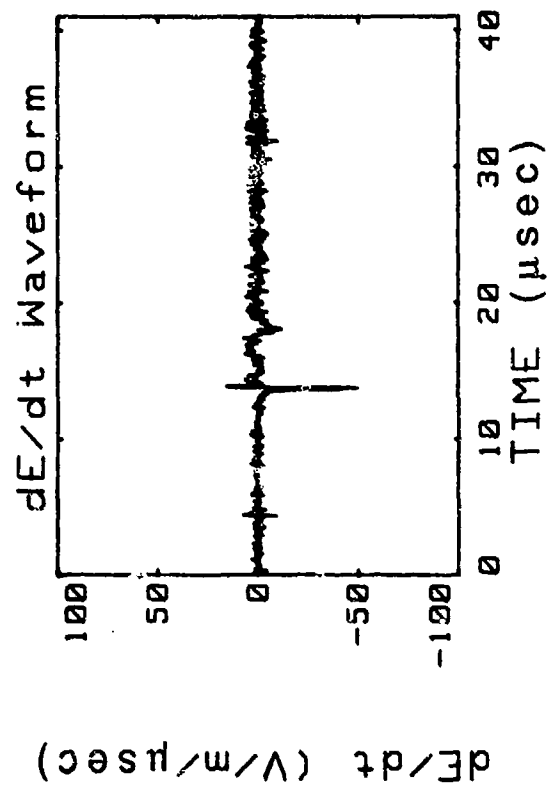
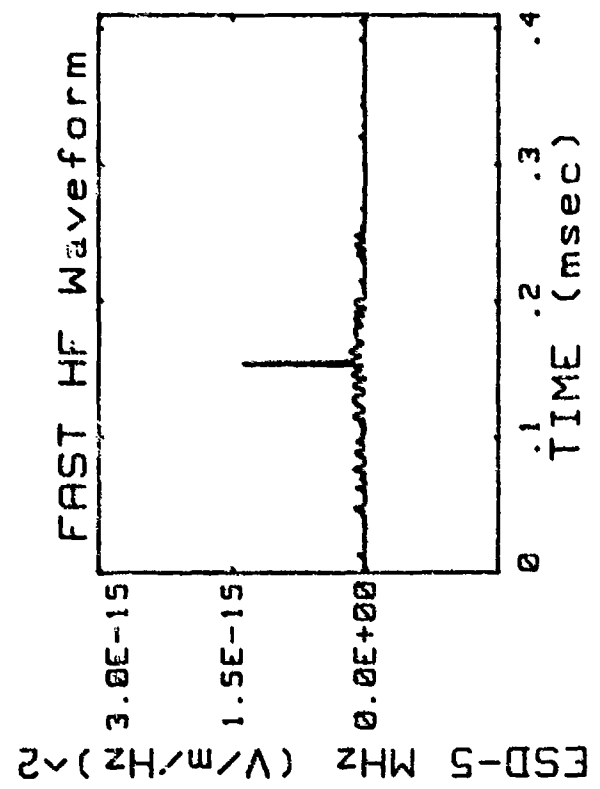
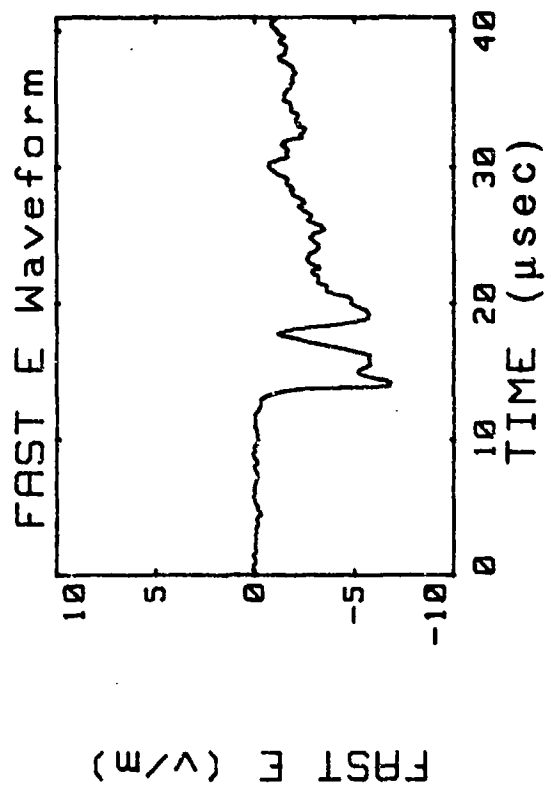
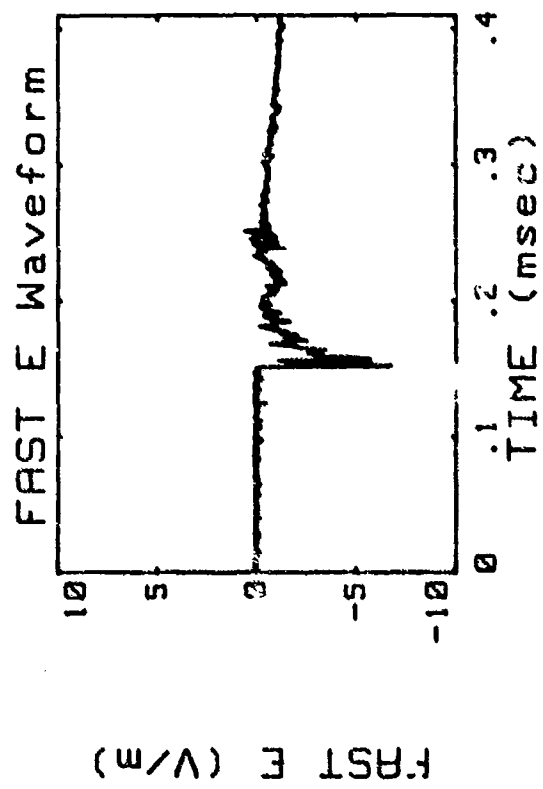


20:42:39.057 8 Aug 1985 (32.8 Km)

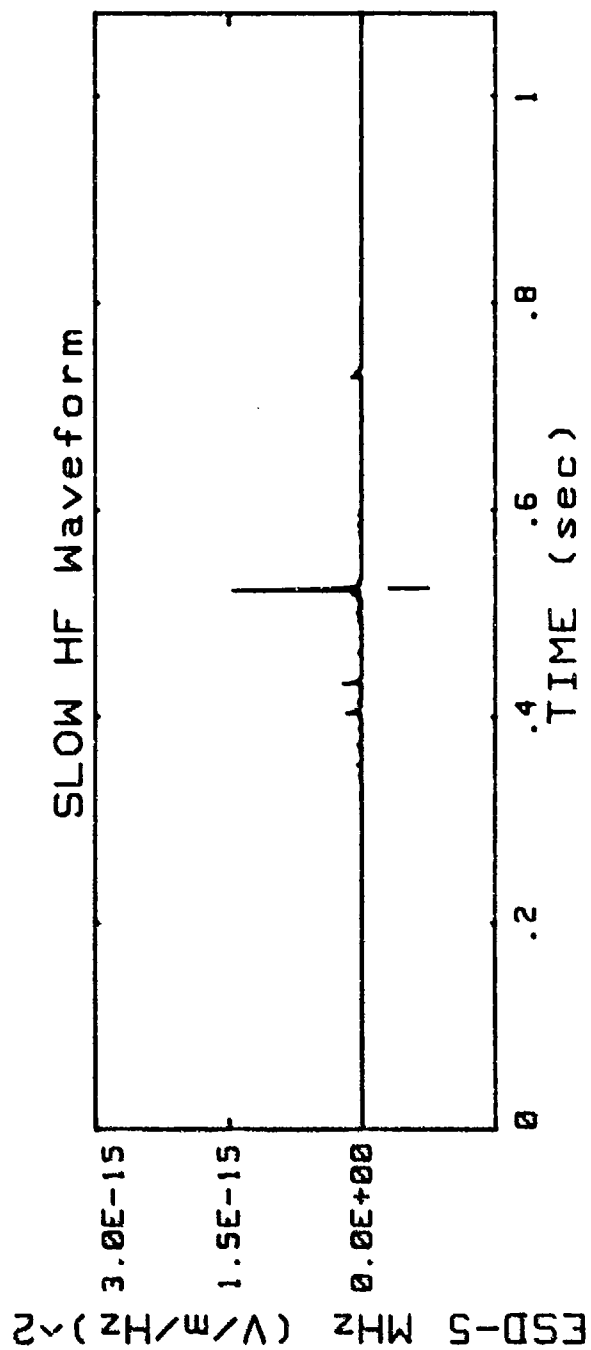
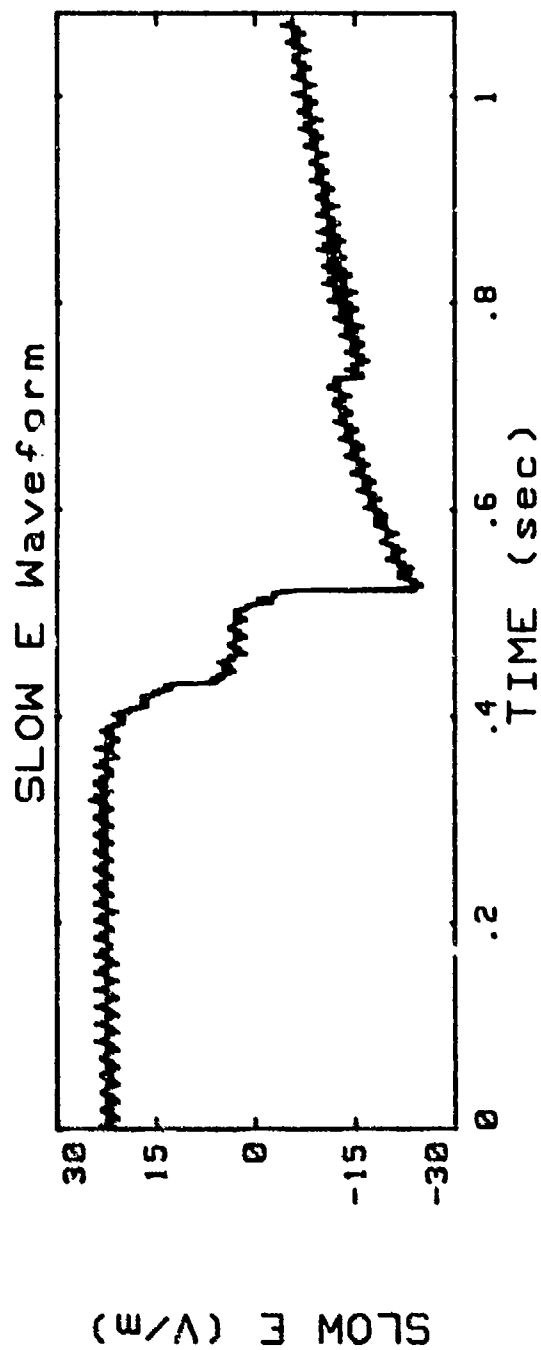


220204343.380 1985

1st RS (33 Km)



20:43:42.868 8 Aug 1985 (33 Km)

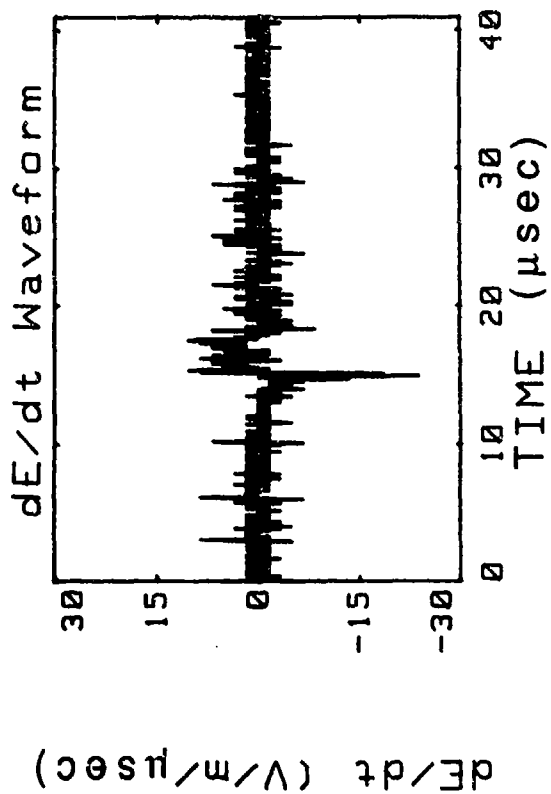
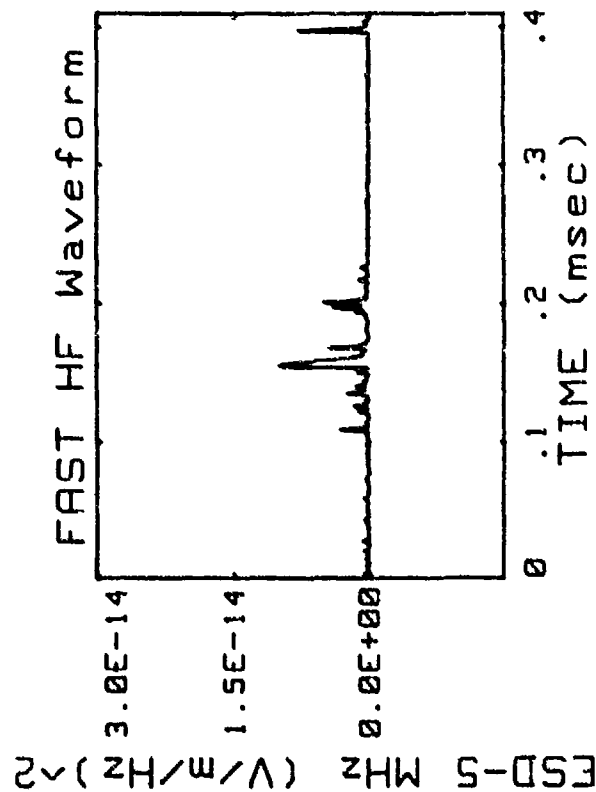
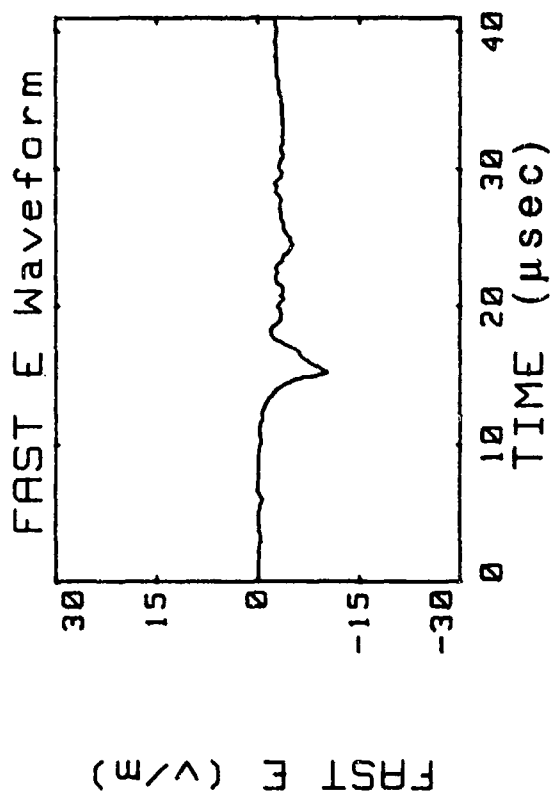
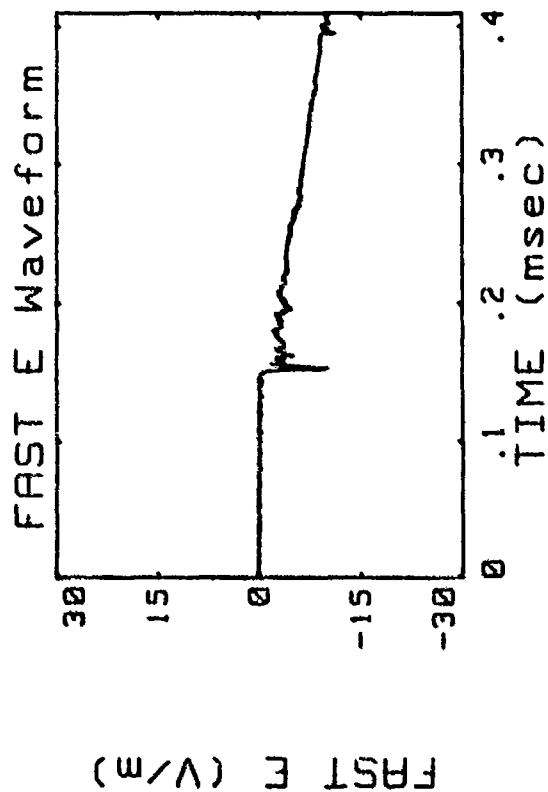


Appendix B

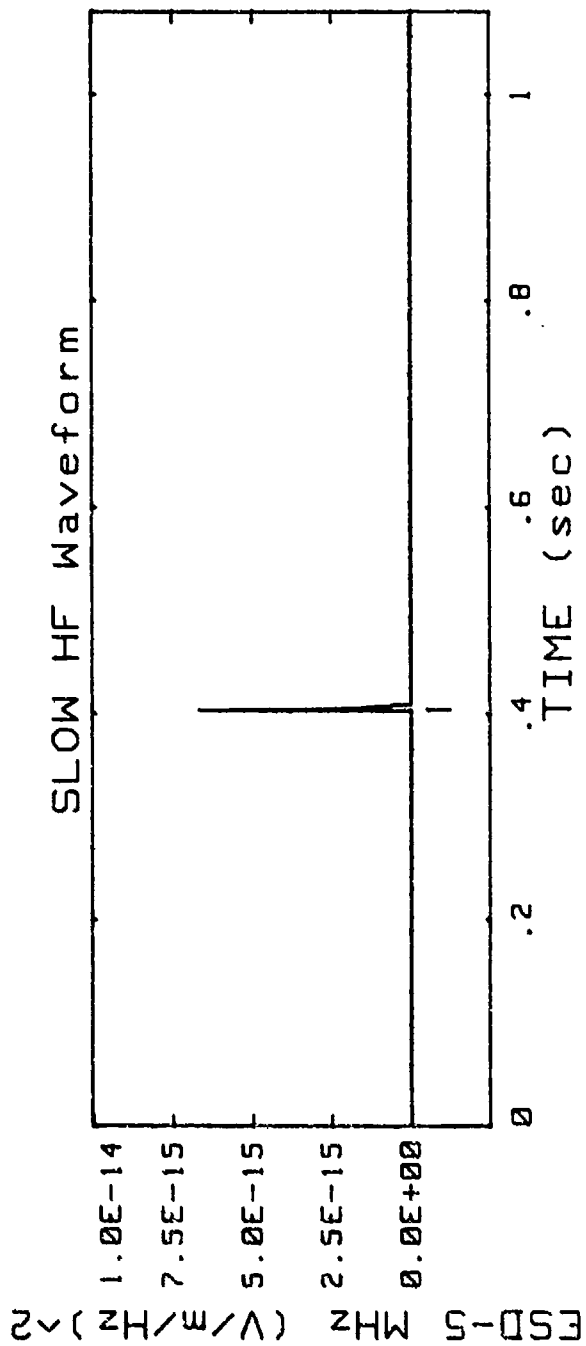
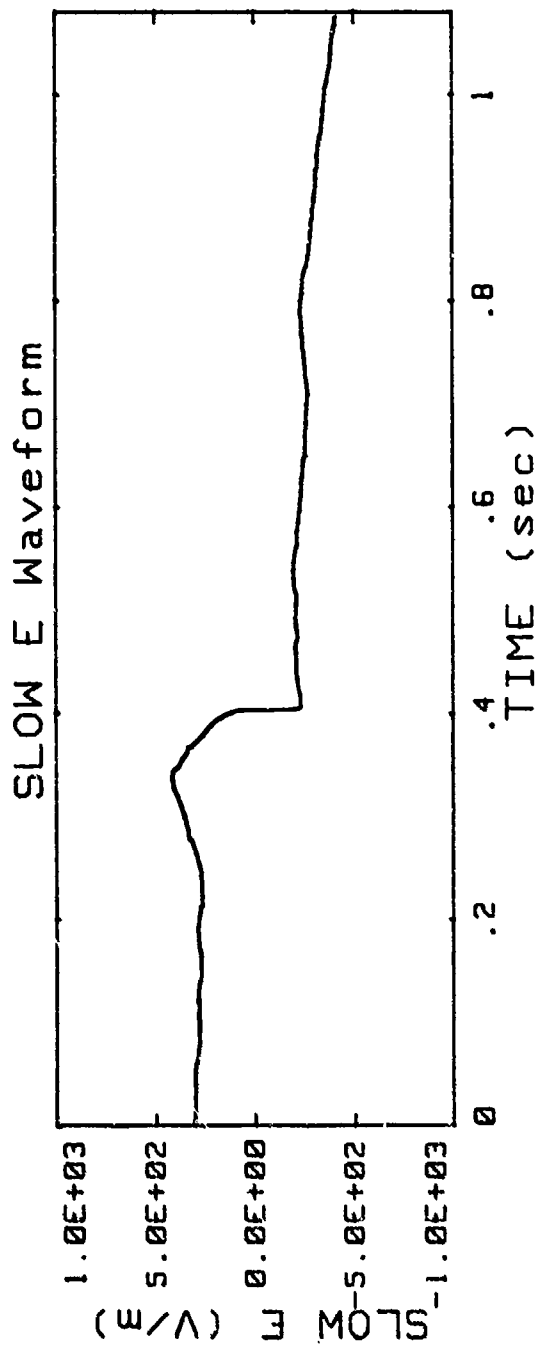
10 August 1985 Data Plots

222164315.759 1985

1st RS (10 Km)

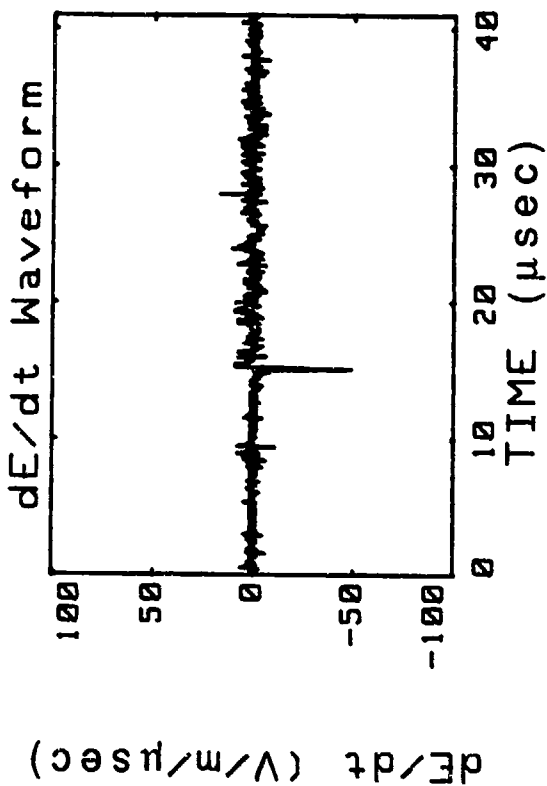
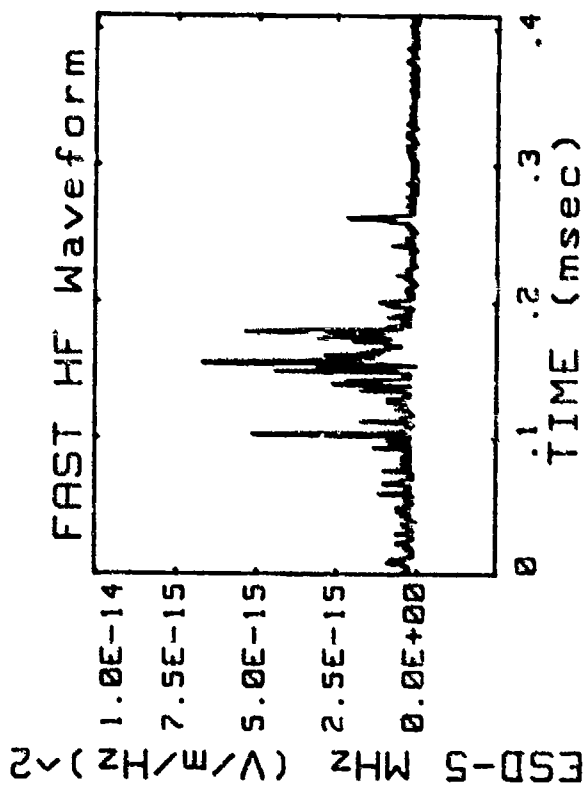
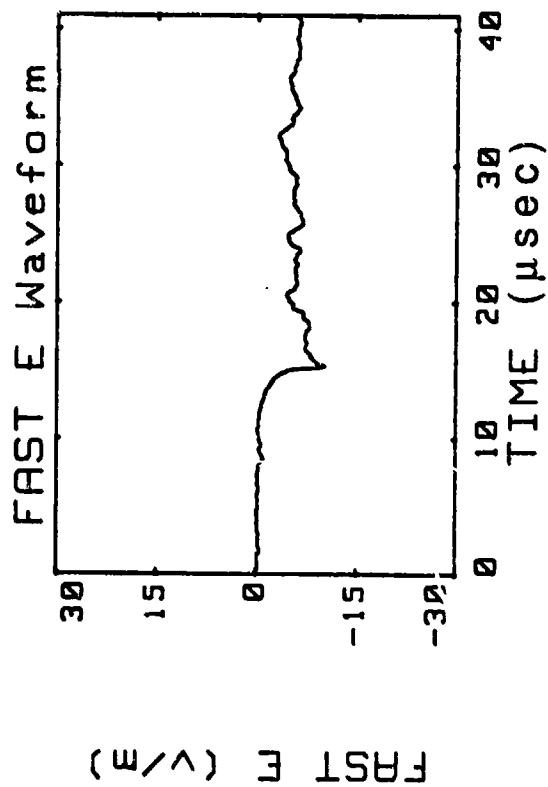
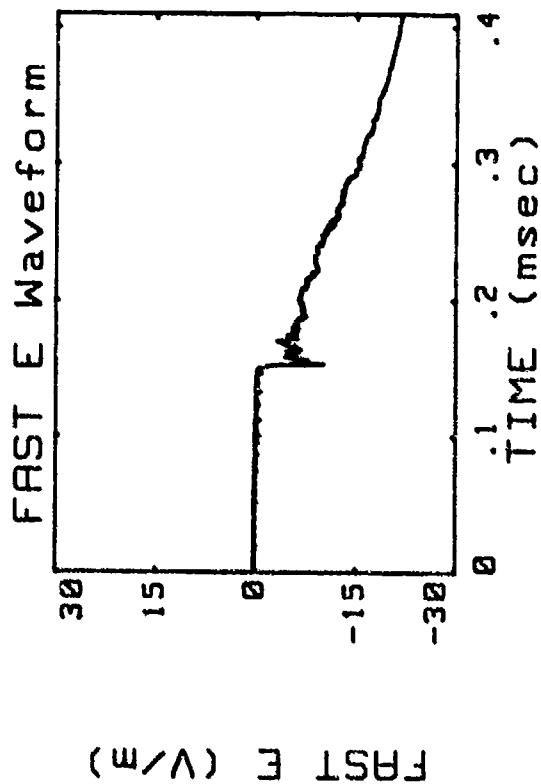


16:43:15.368 10 Aug 1985 (10 Km)

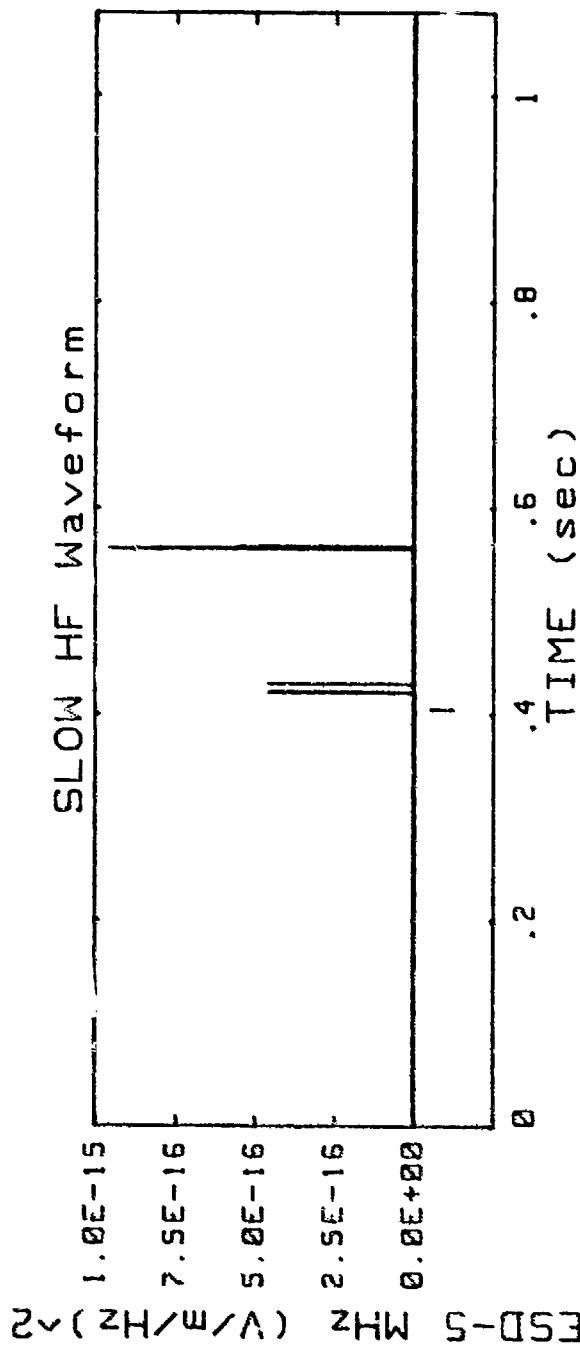
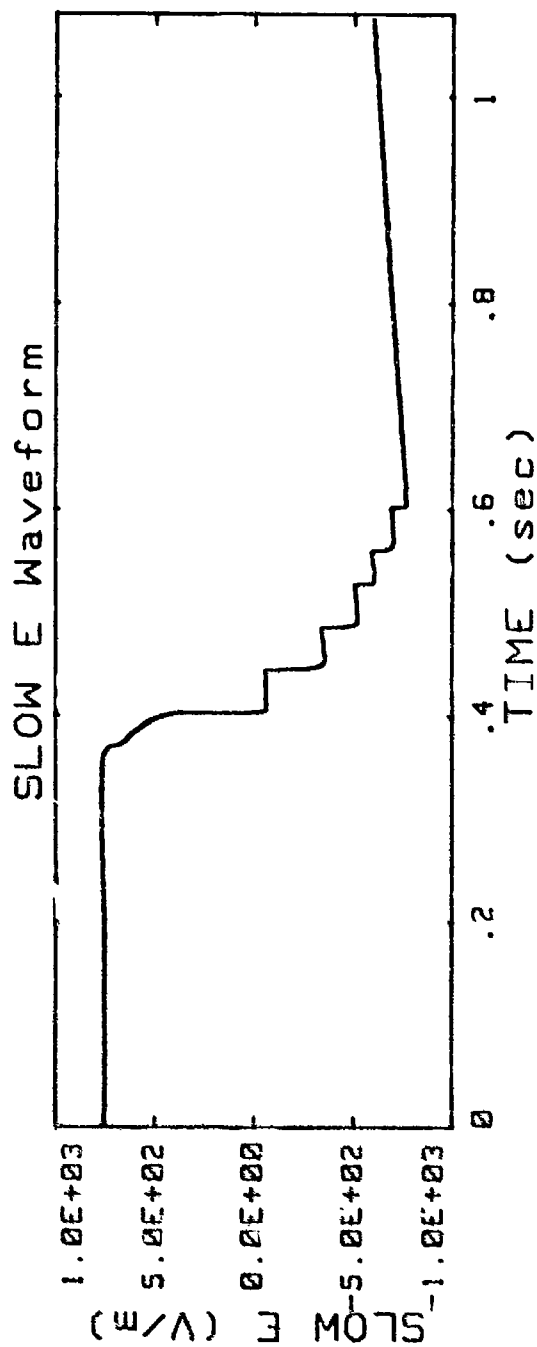


222164717.527 1985

1st RS (9.3 Km)

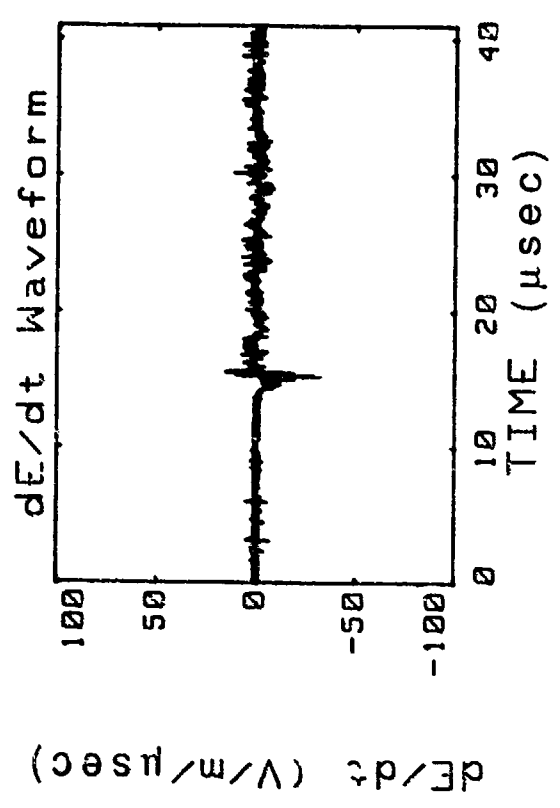
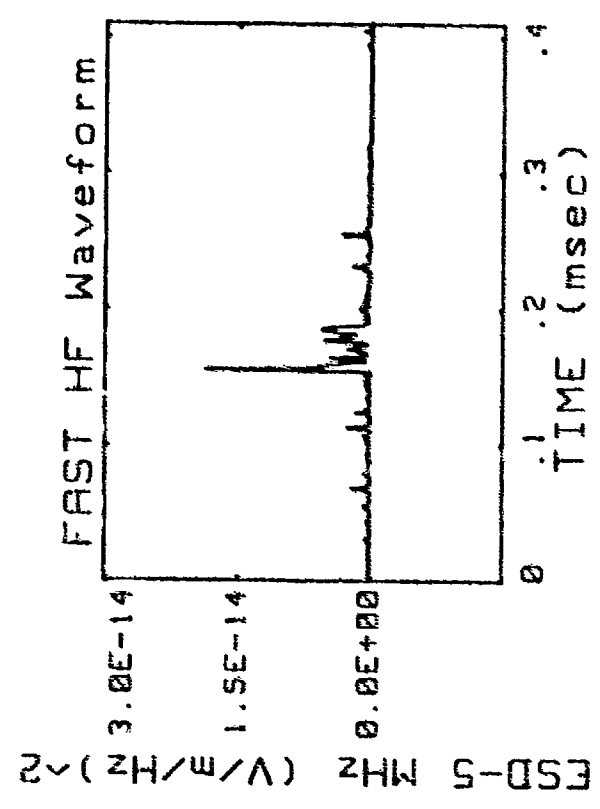
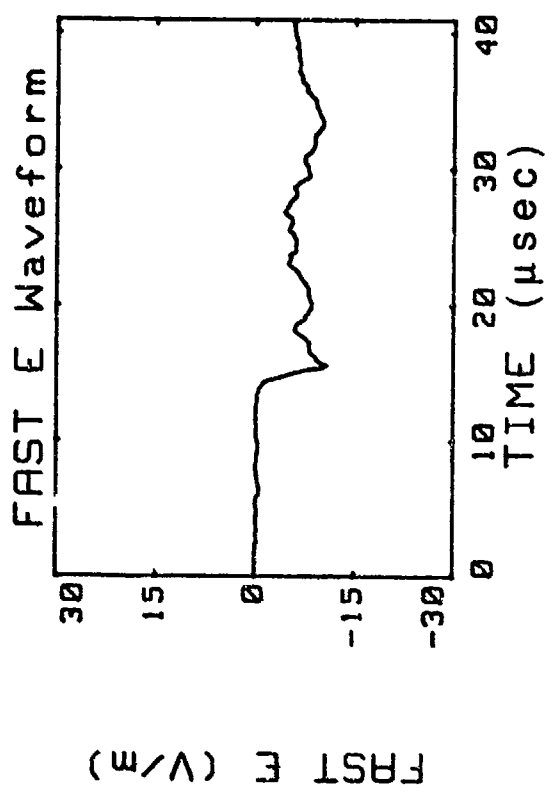
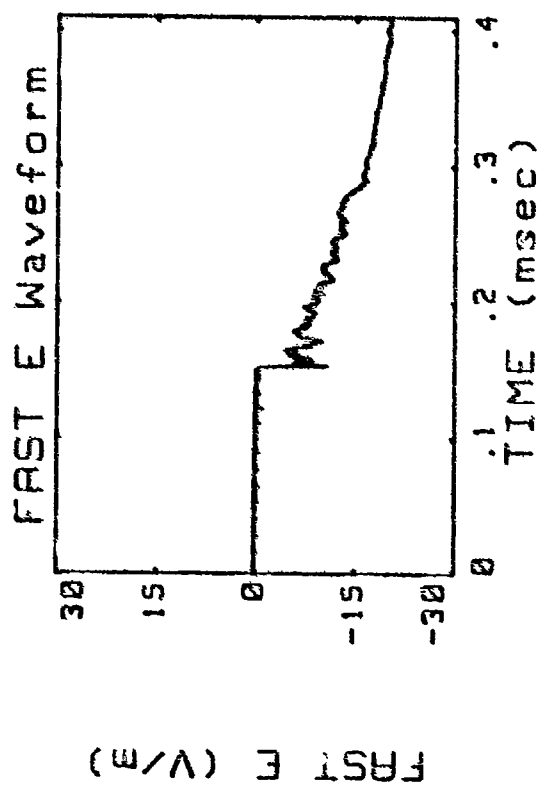


16:47:17.135 10 Aug 1985 (9.3 Km)

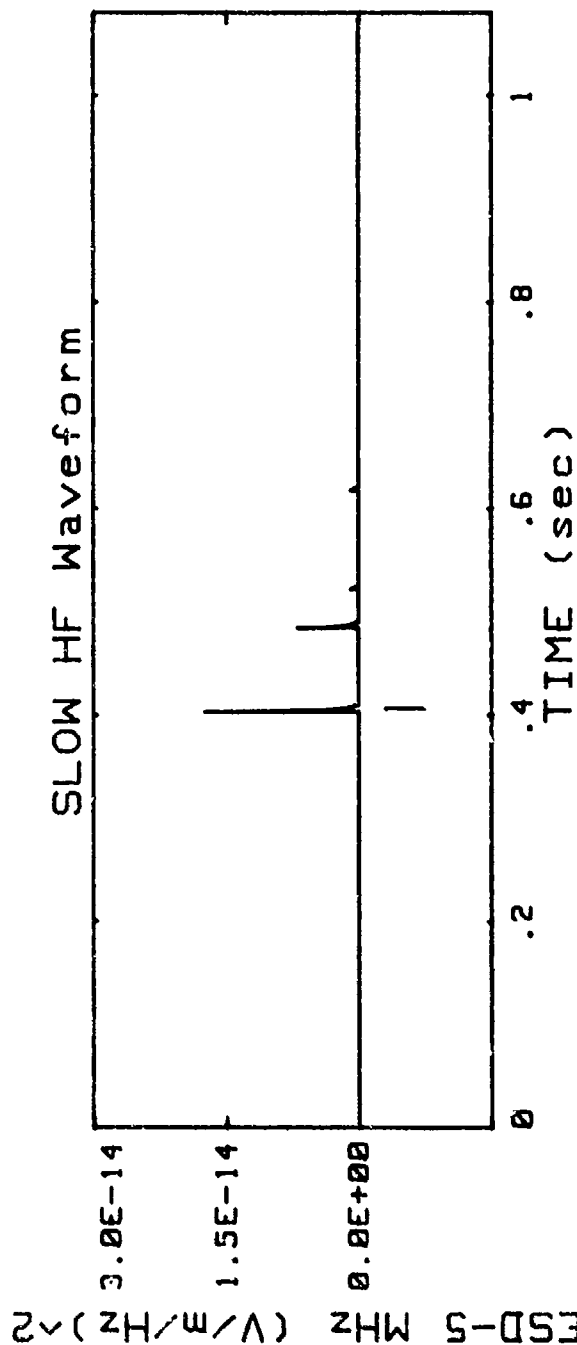
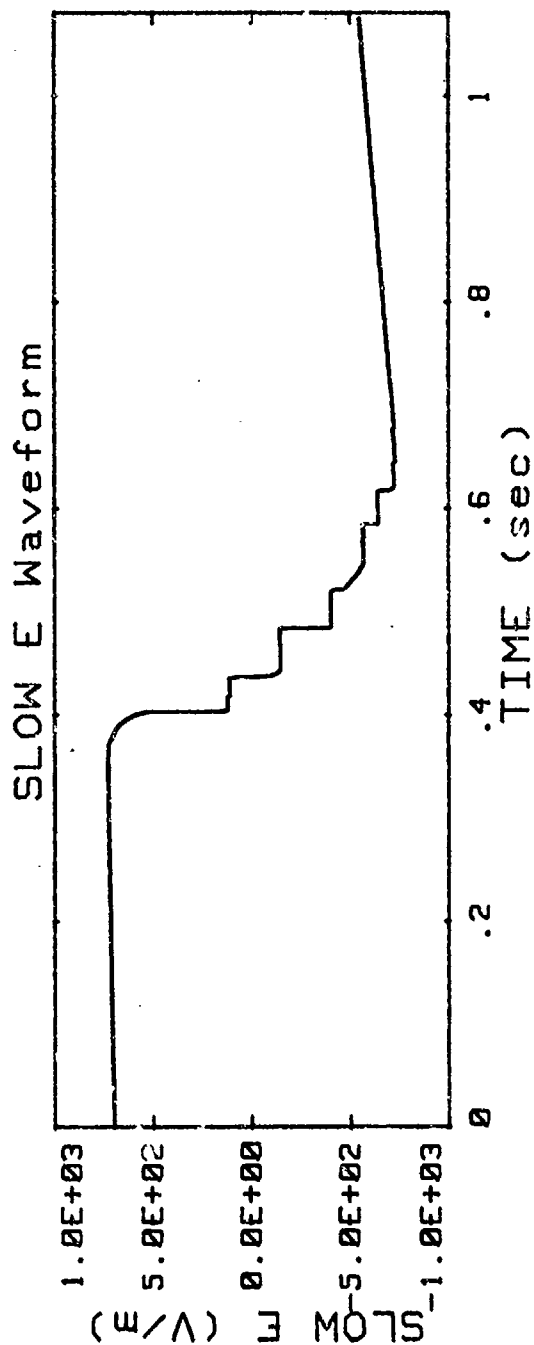


222164926.754 1985

1st RS (7.9 Km)

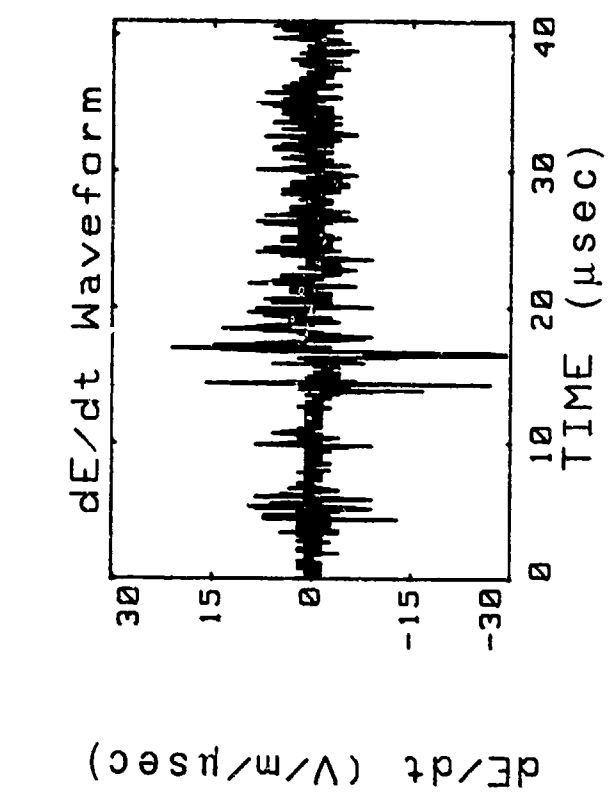
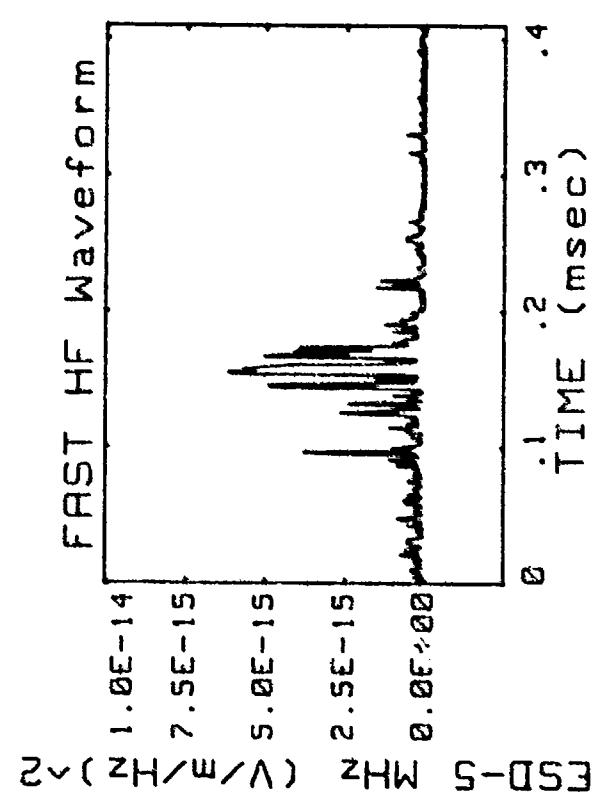
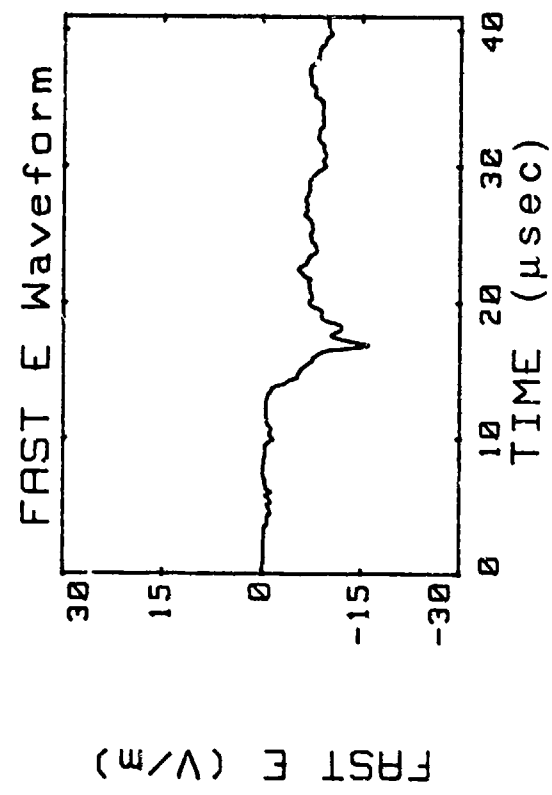
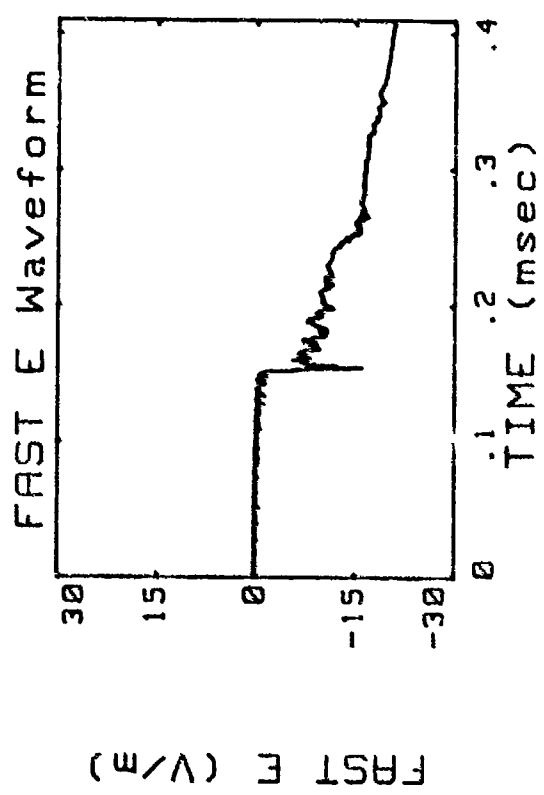


16:49:26.360 10 Aug 1985 (7.9 Km)

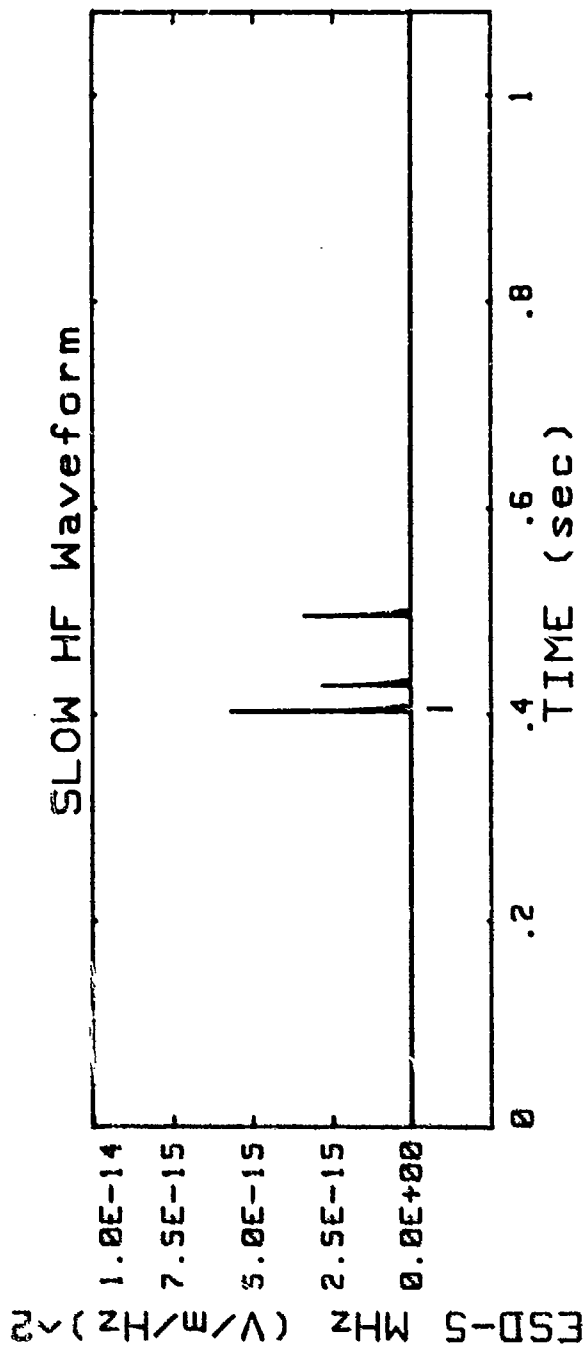
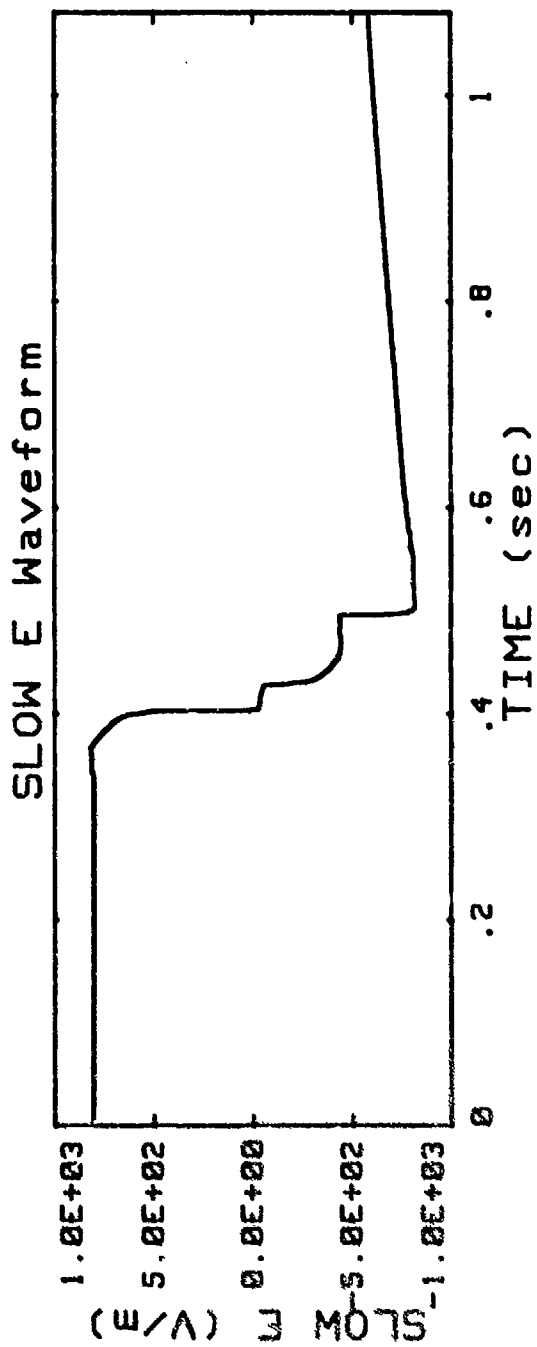


222164942.145 1985

1st RS (7.4 Km)

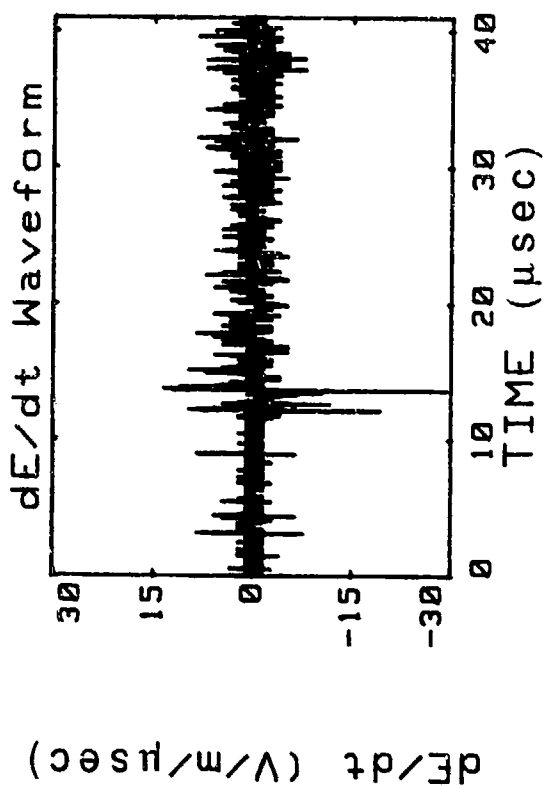
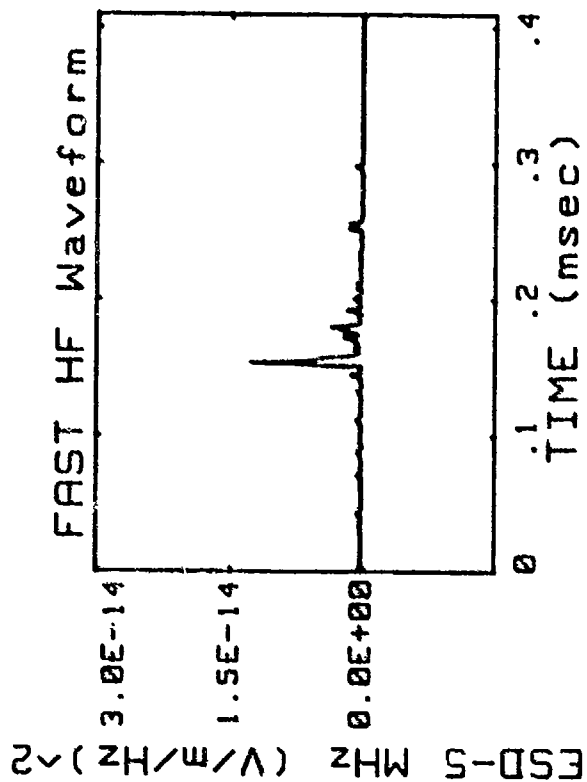
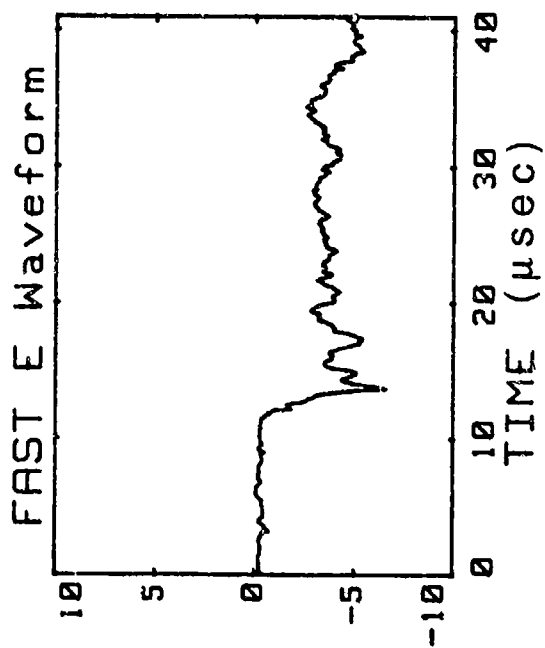
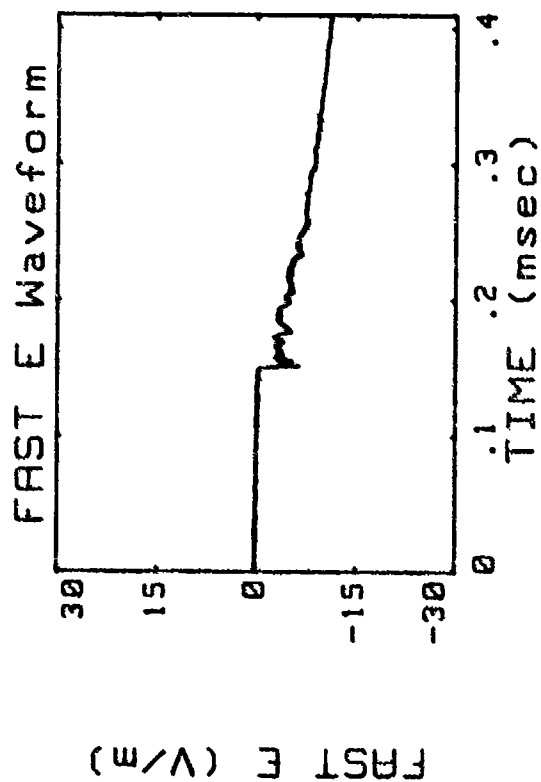


16:49:41.752 10 Aug 1985 (7.4 Km)

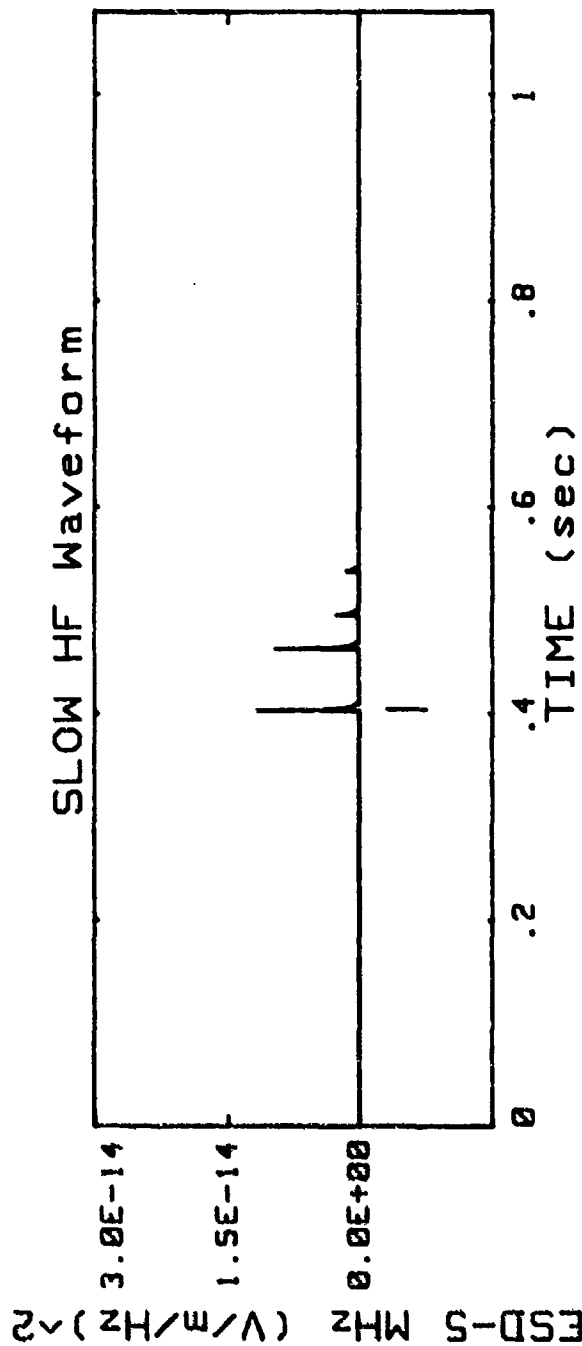
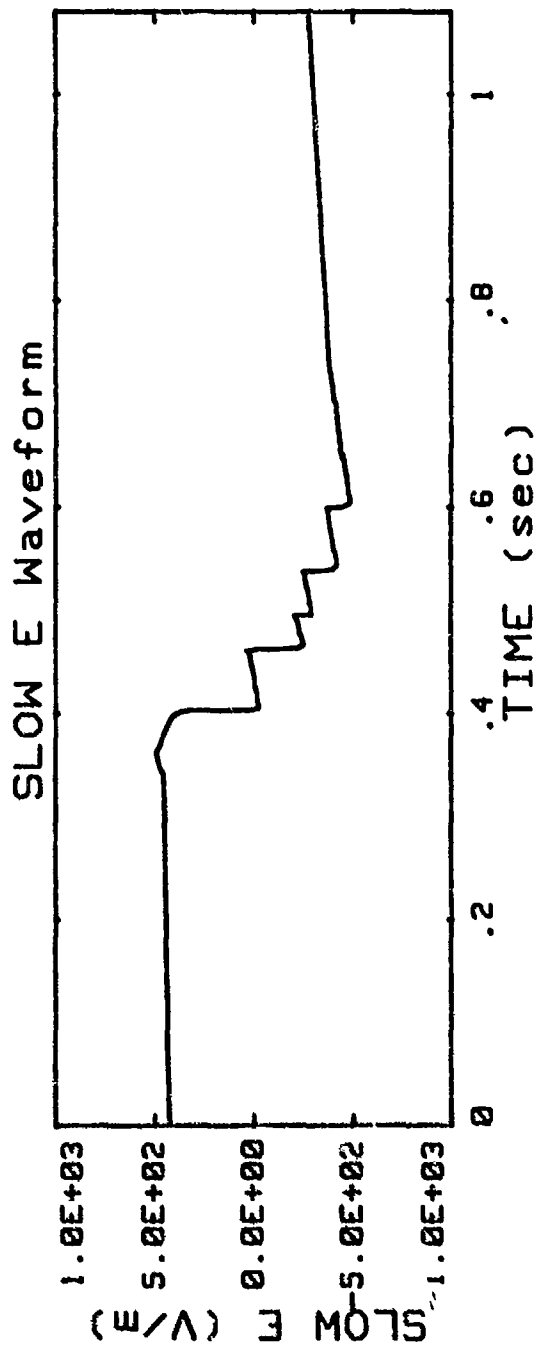


222165001.468 1985

1st RS (7.4 Km)

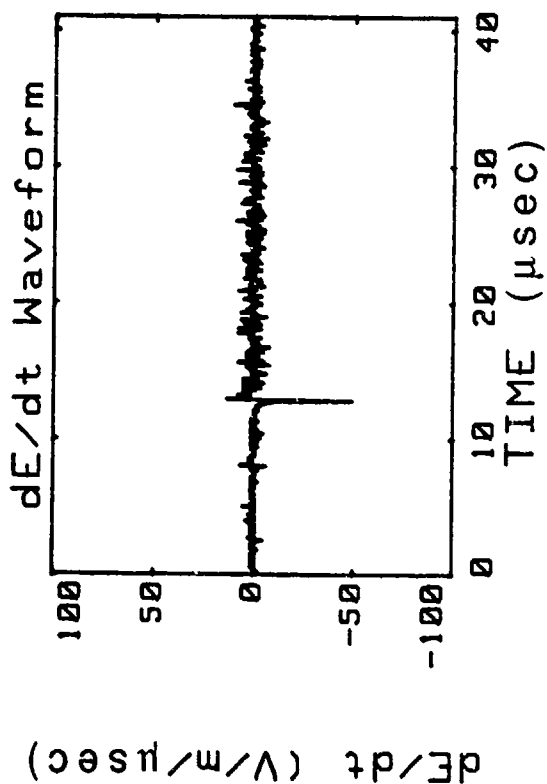
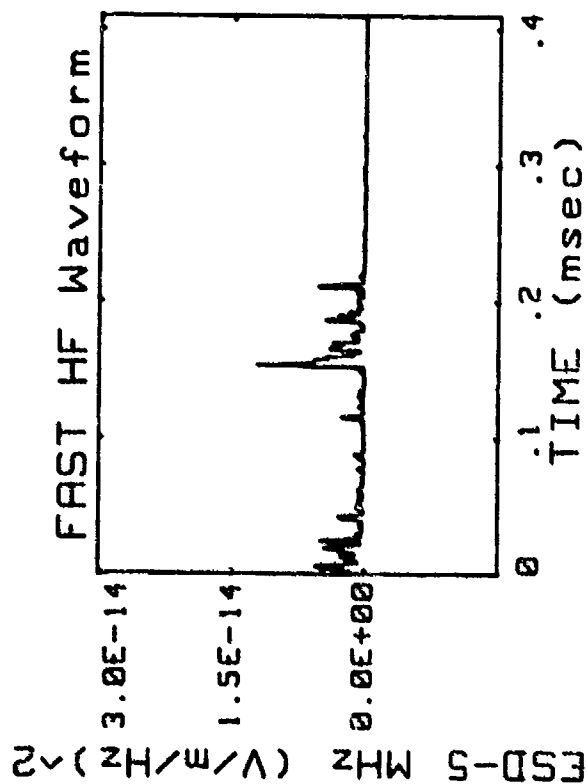
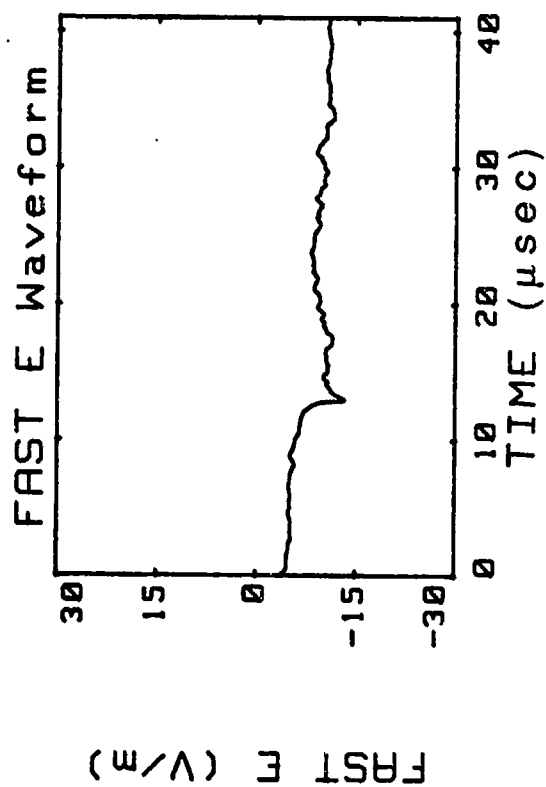
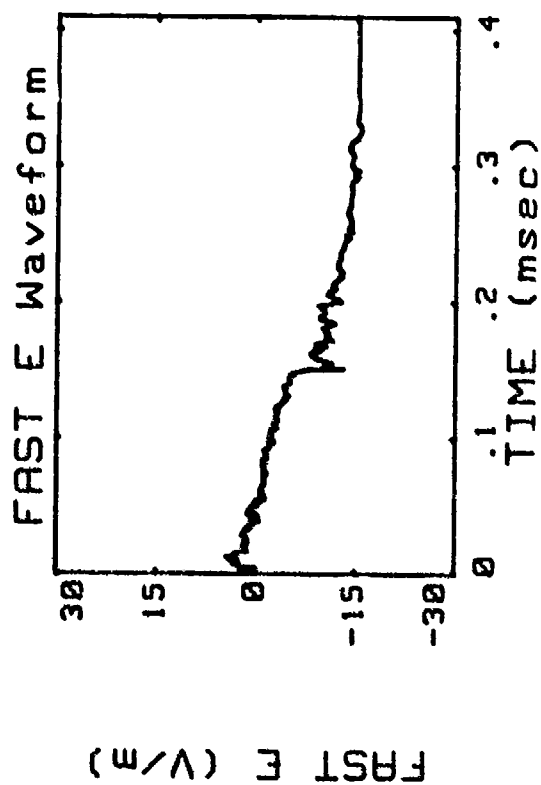


16:50:01.076 10 Aug 1985 (7.4 Km)

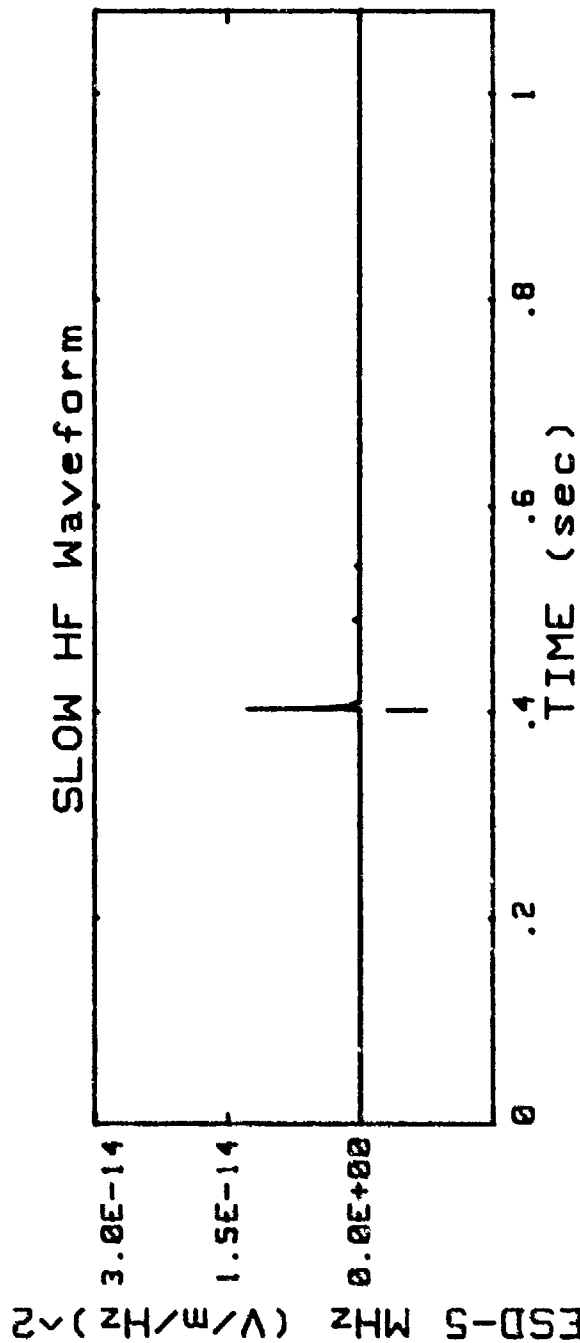
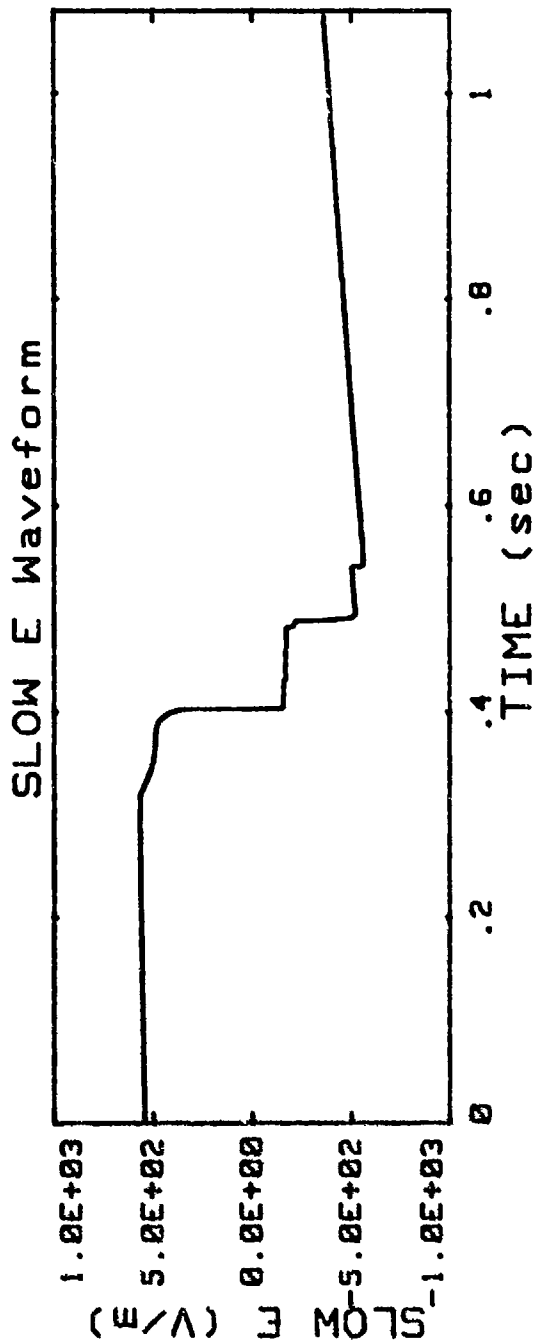


222165028.387 1985

1st RS (8.1 Km)

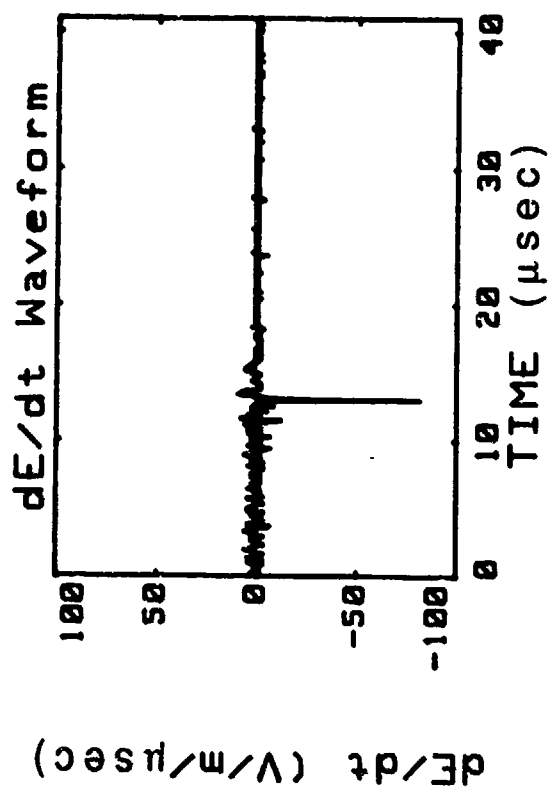
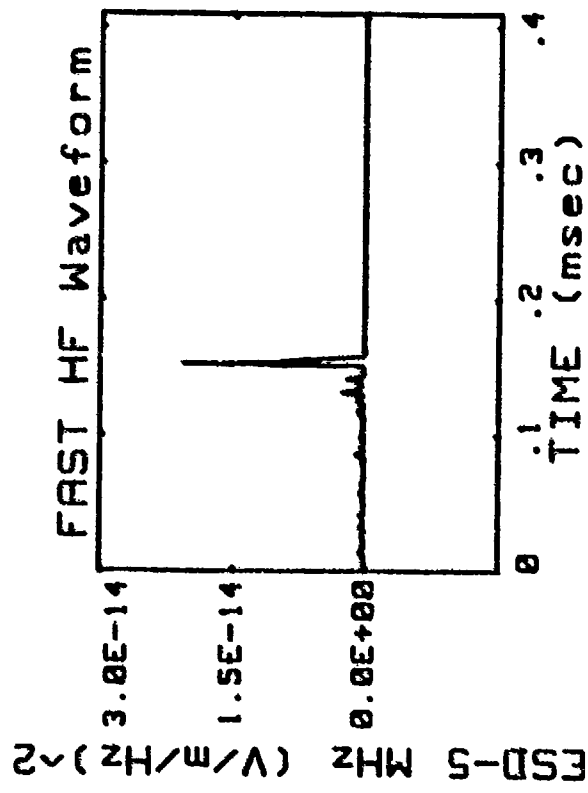
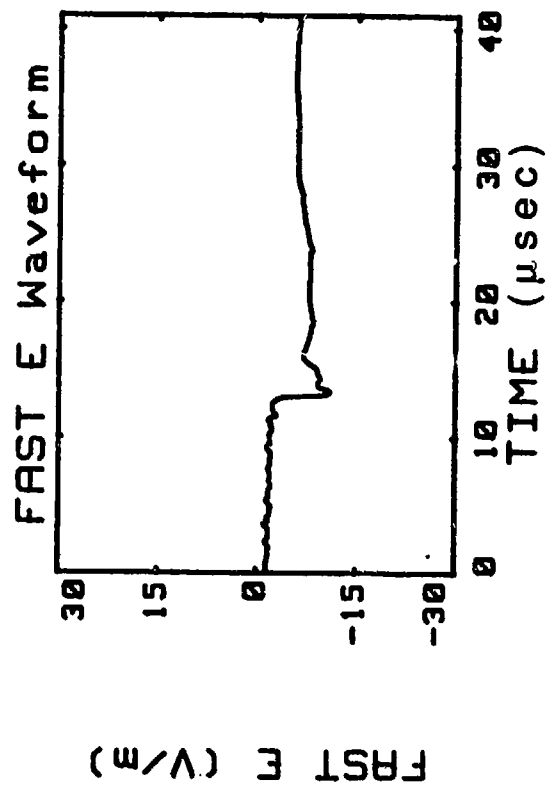
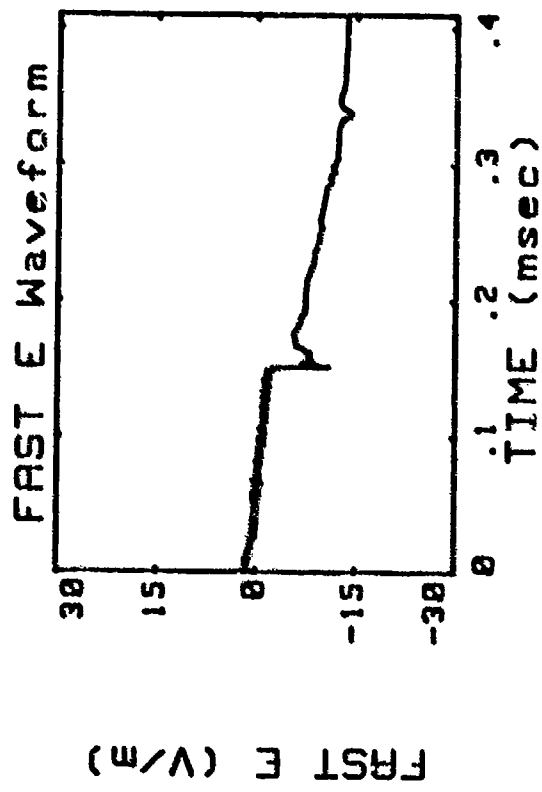


16:50:27.998 10 Aug 1985 (8.1 Km)

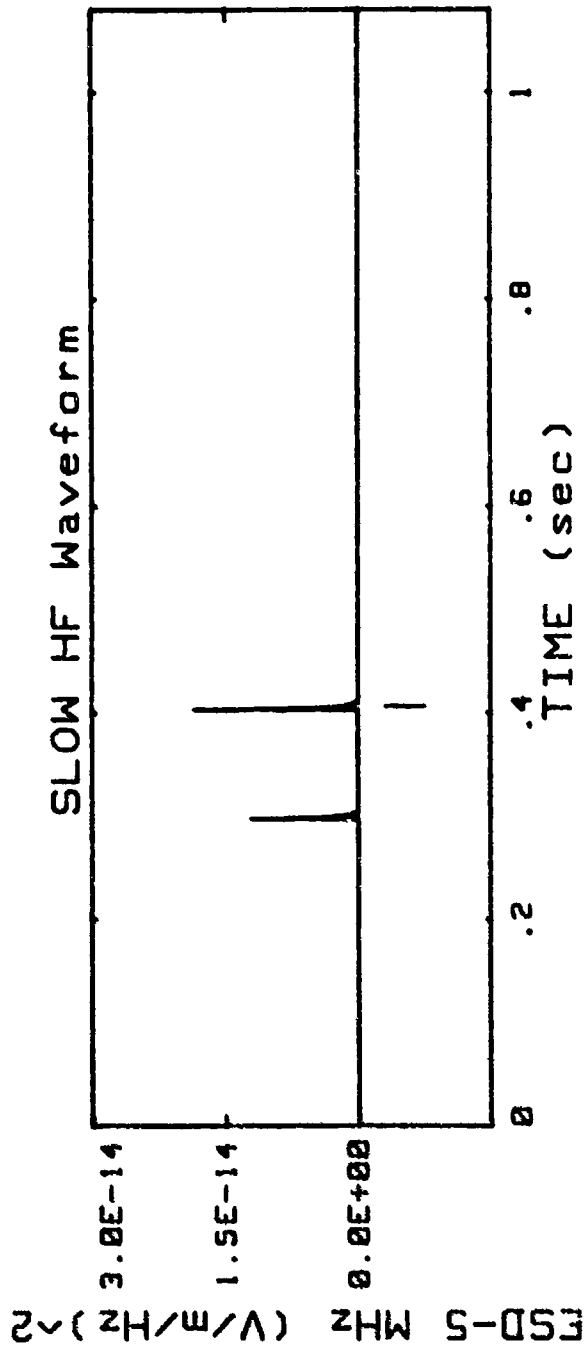
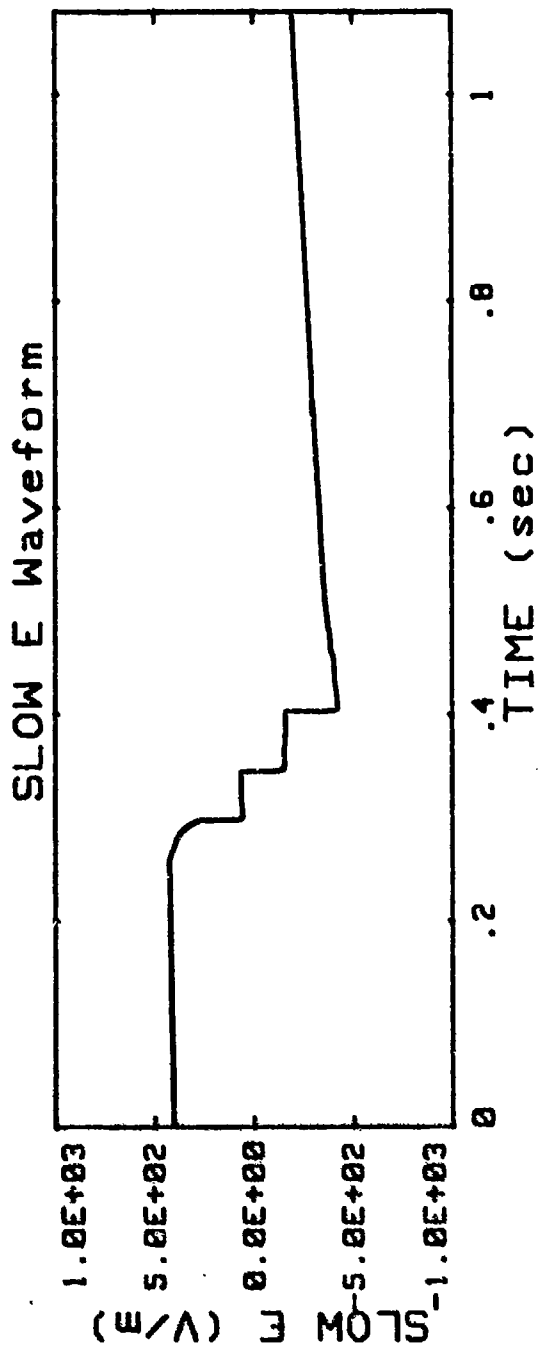


222165123.534 1985

Chaotic Subs RS (9.9 Km)

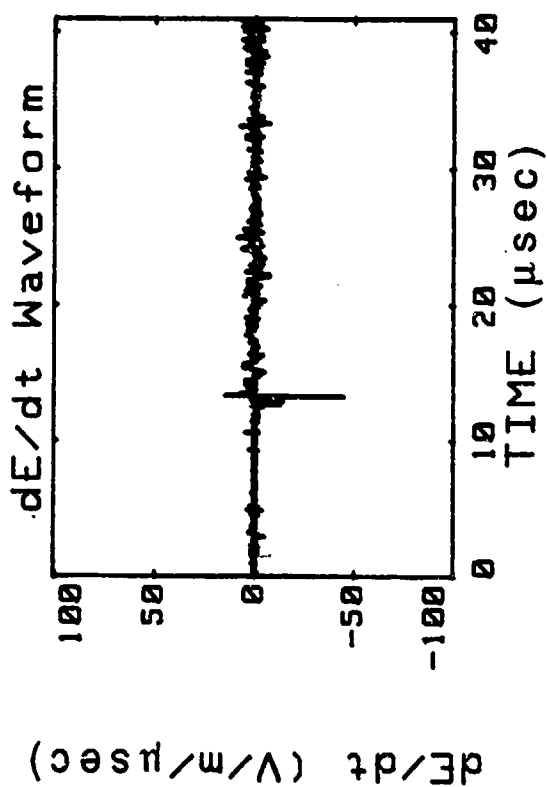
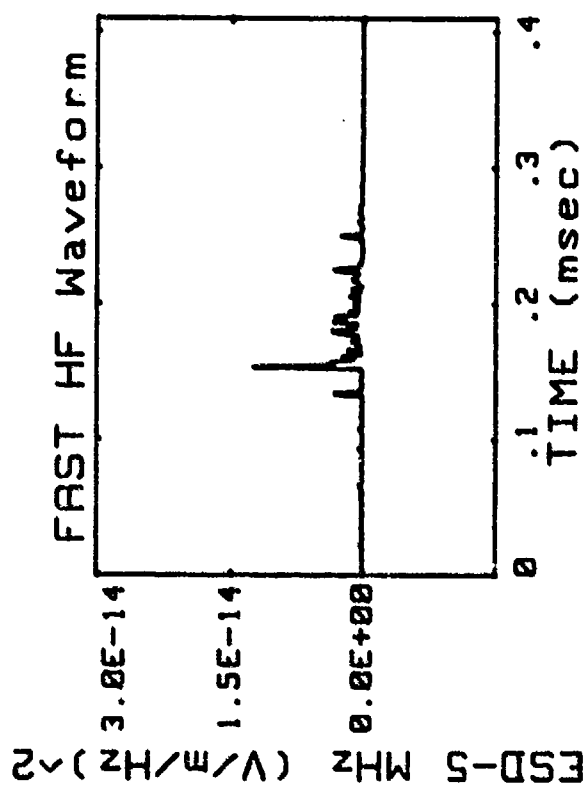
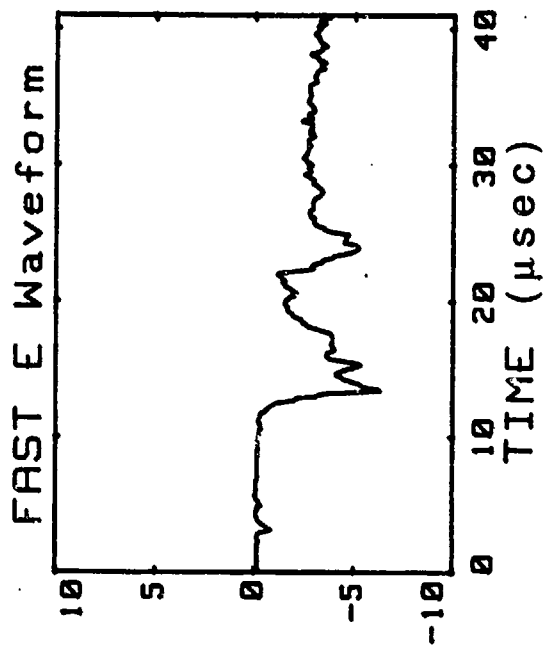
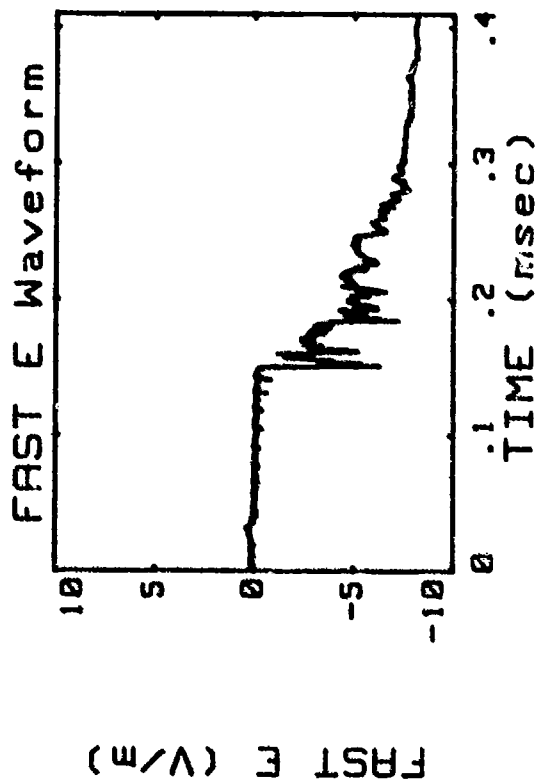


16:51:23.140 10 Aug 1985 (9.9 Km)

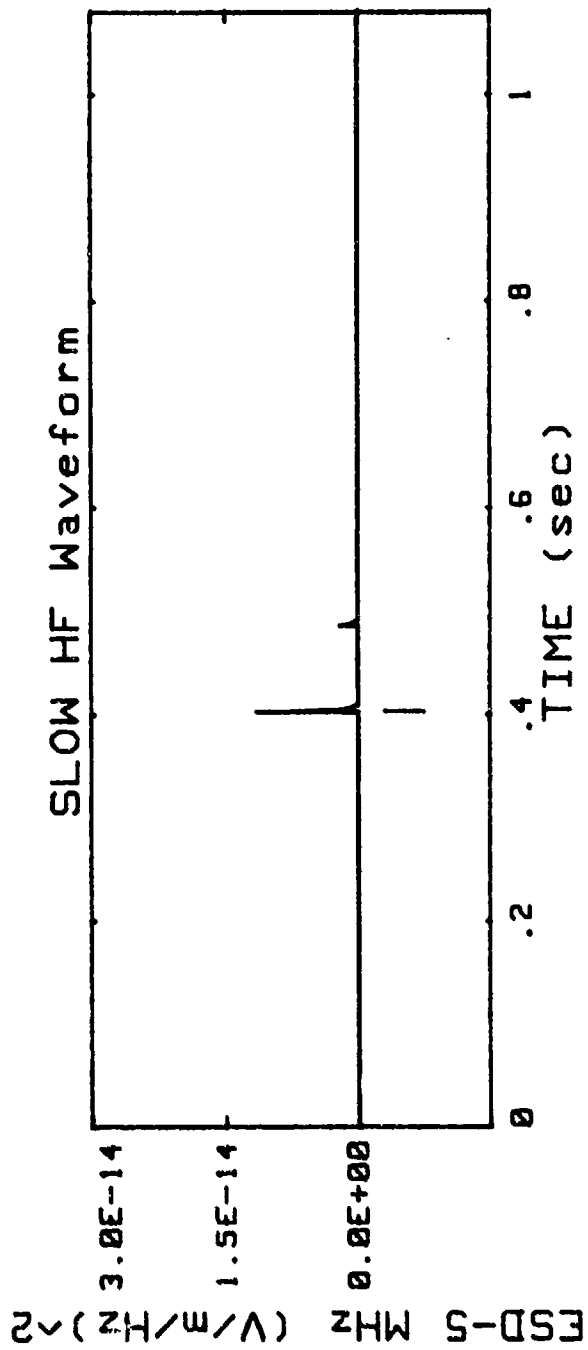
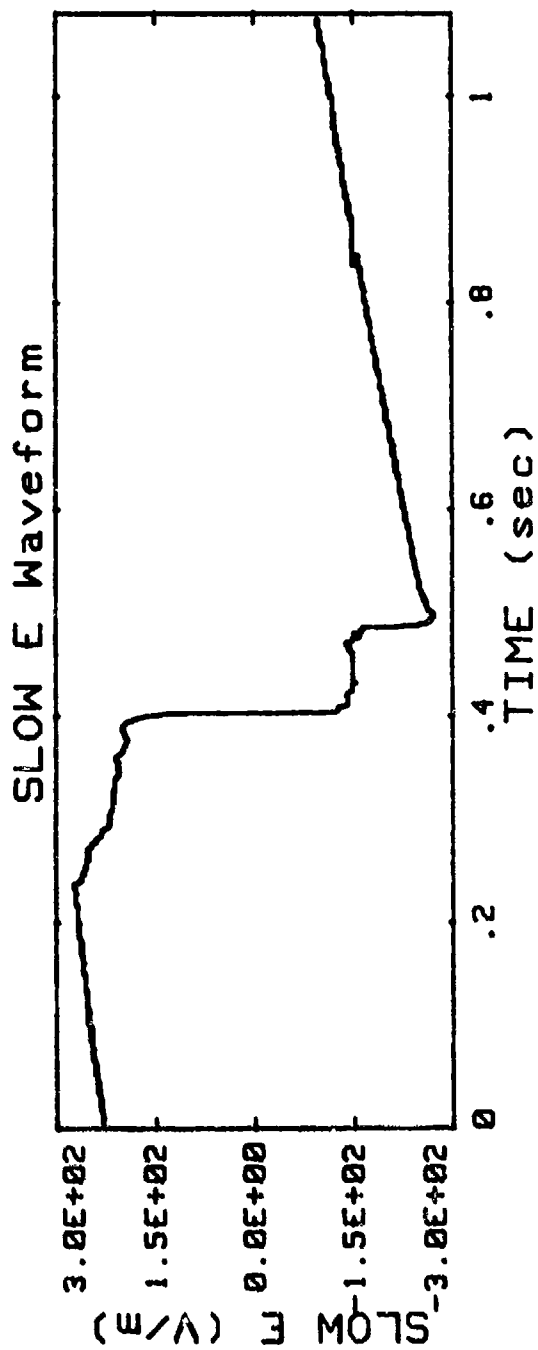


222165200.904 1985

1st RS (6.4 Km)

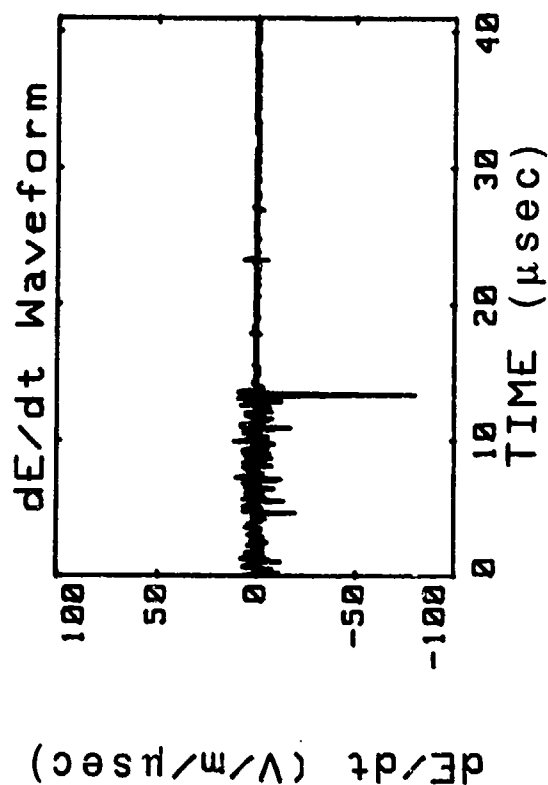
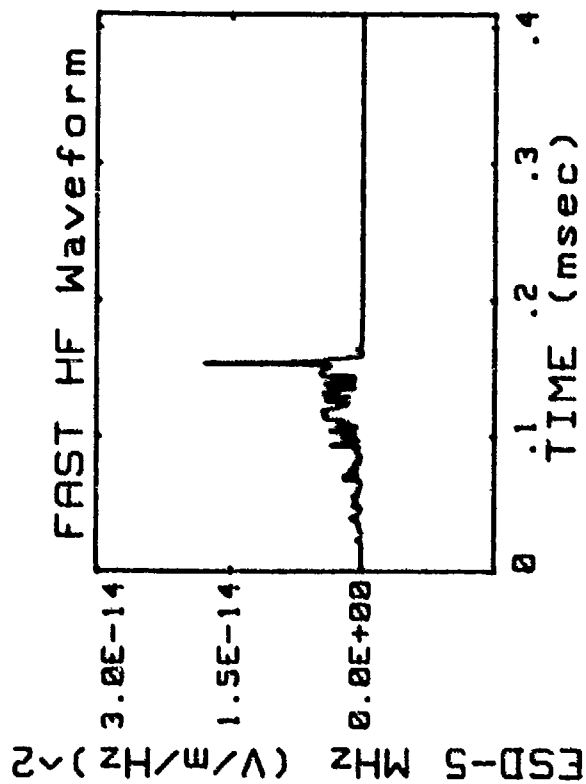
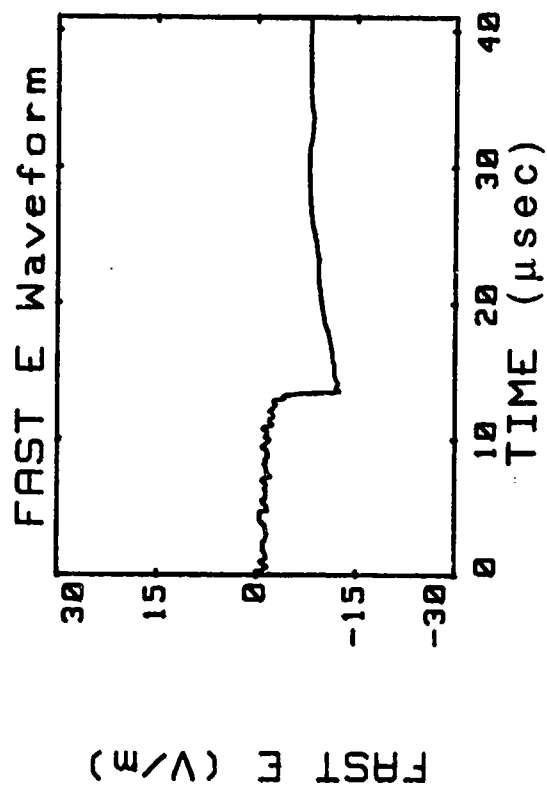
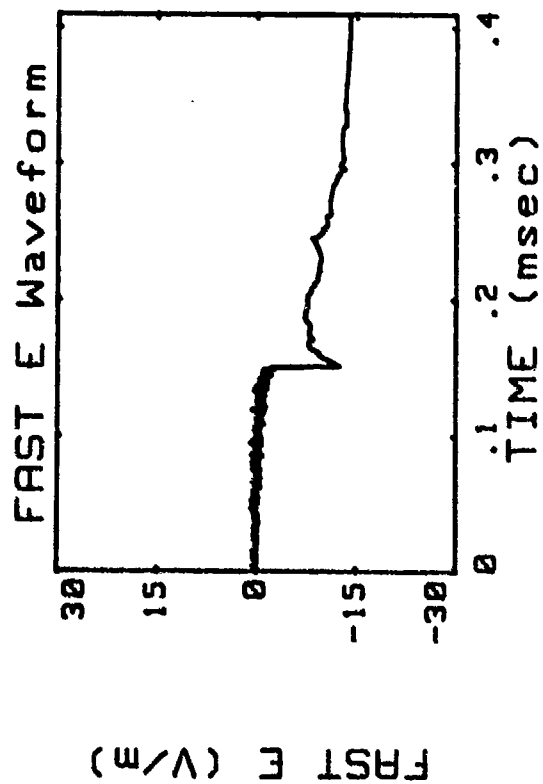


16:52:00.513 10 Aug 1985 (6.4 Km)

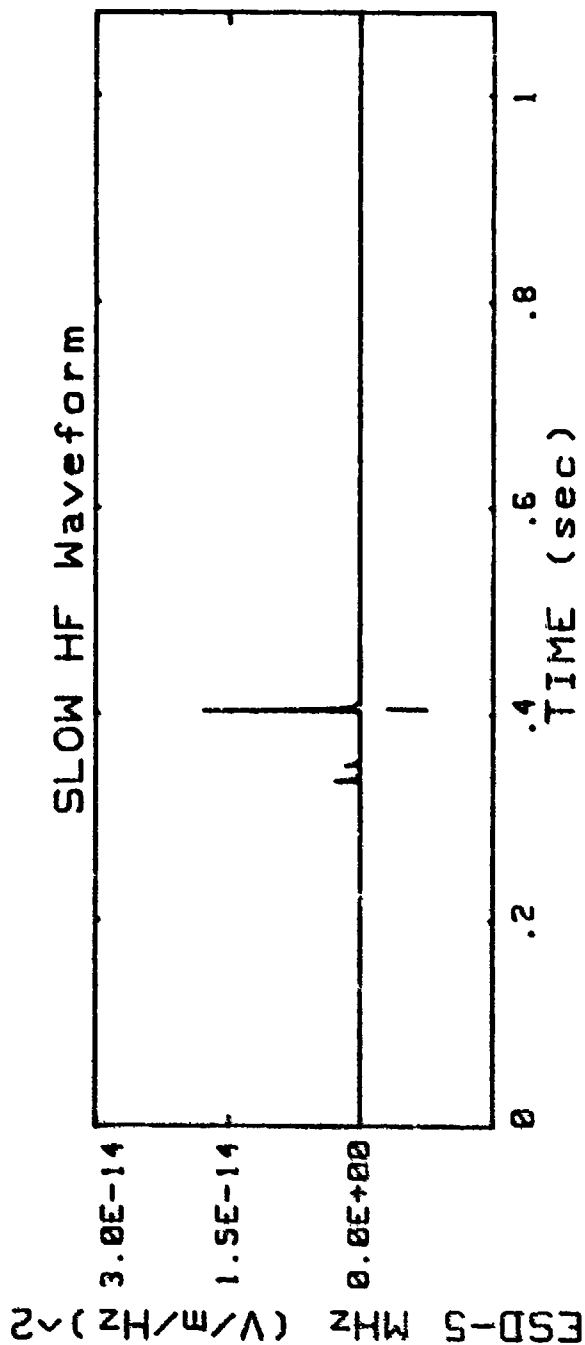
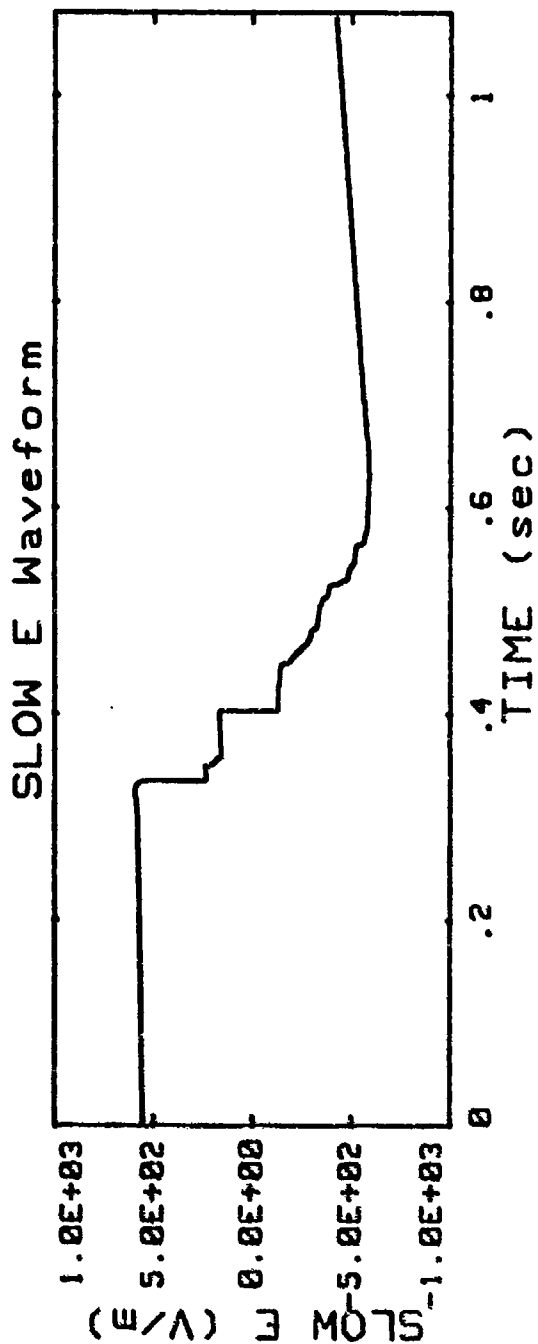


222165216.021 1985

Chaotic Subs RS (6.8 Km)

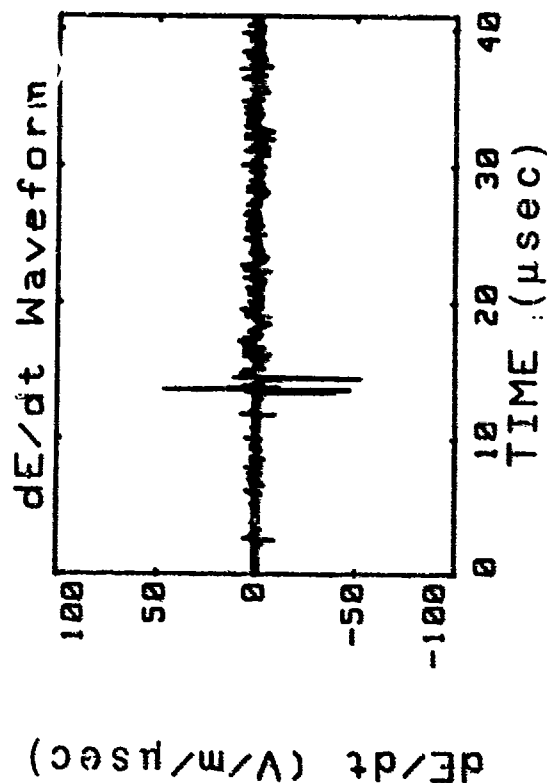
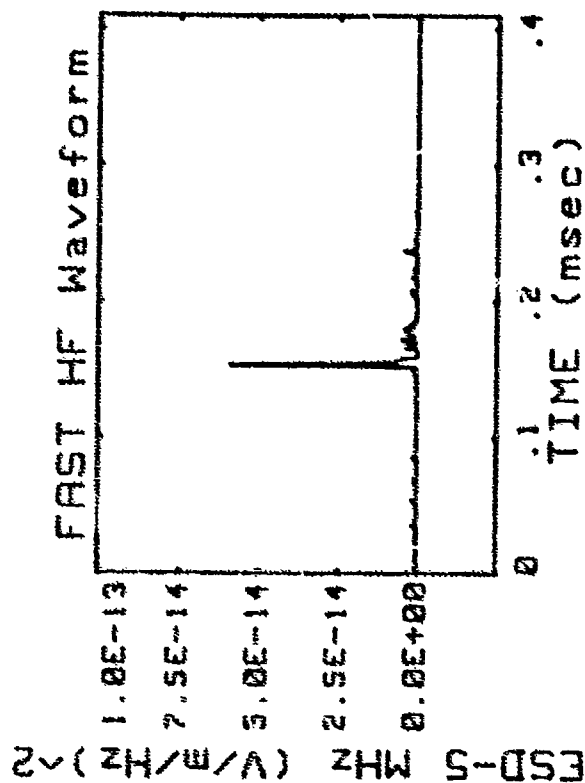
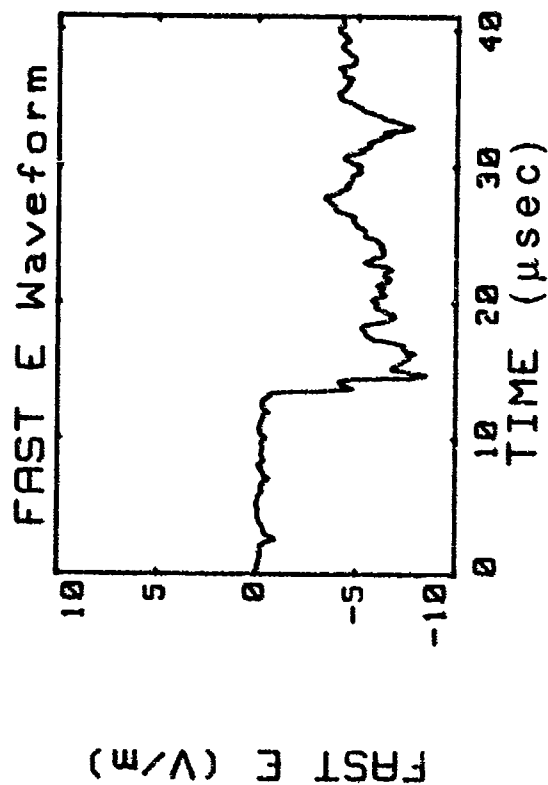
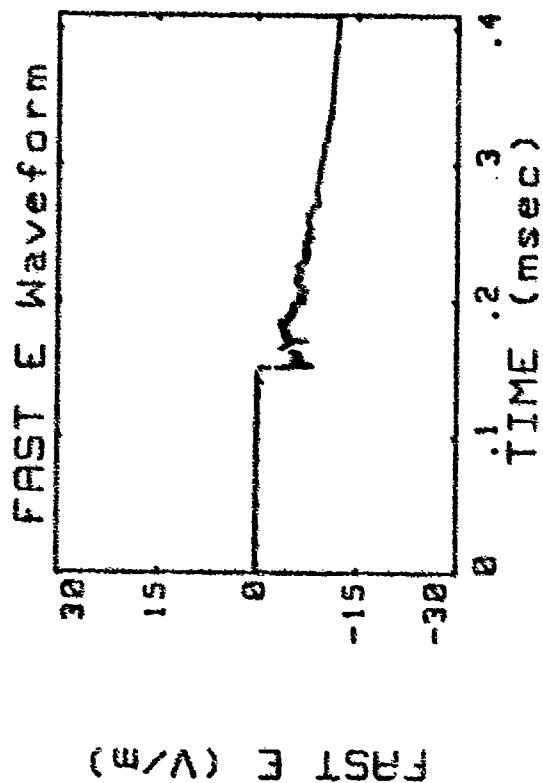


16:52:15.629 10 Aug 1985 (6.8 Km)



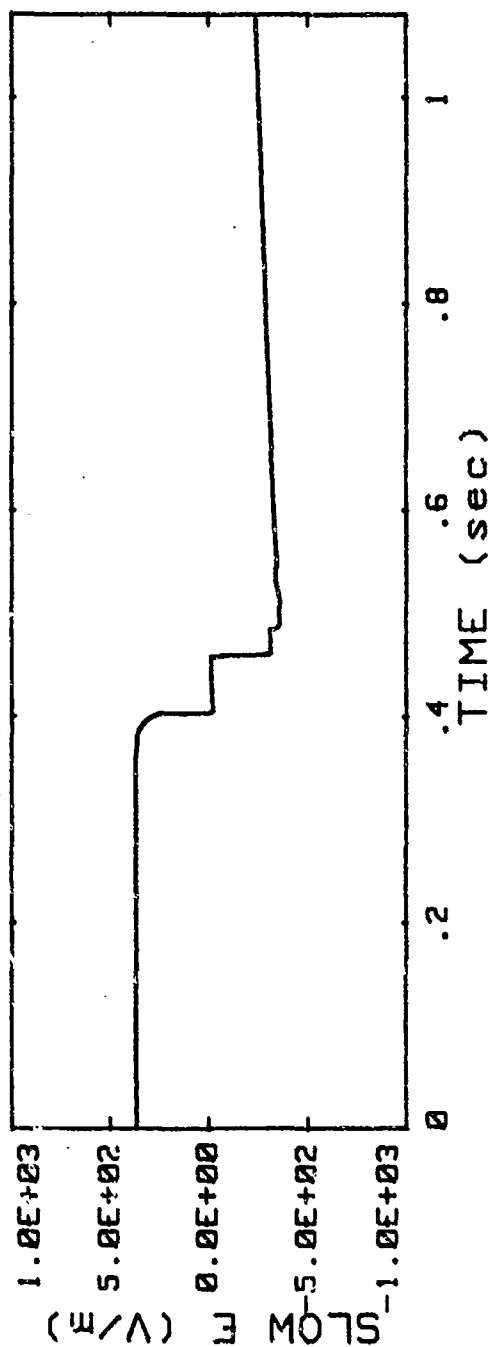
222165248.159 1985

1st RS (7.9 Km)

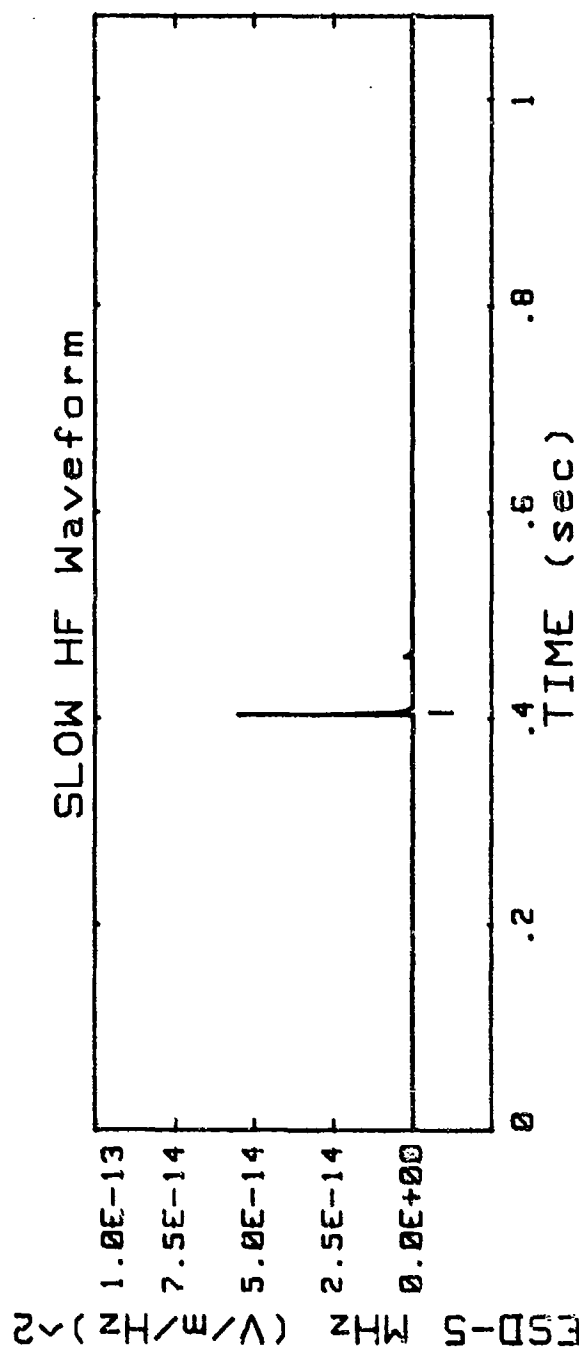


16:52:47.766 10 Aug 1985 (7.9 Km)

SLOW E Waveform

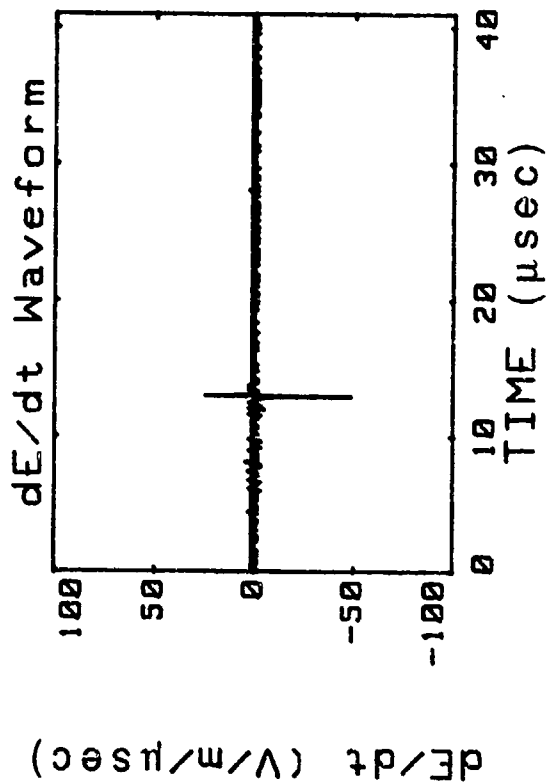
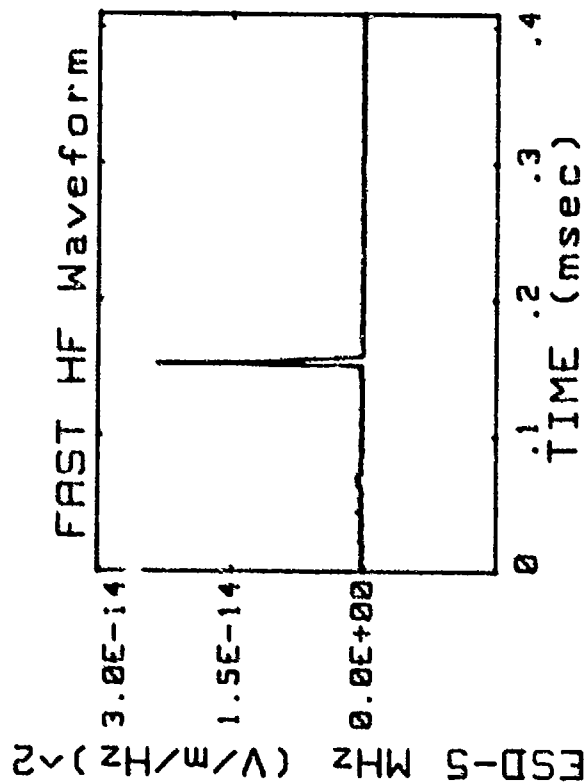
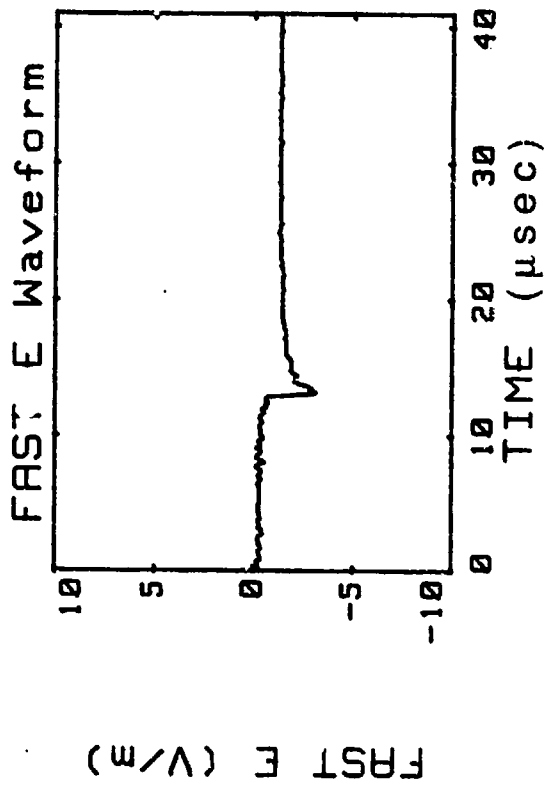
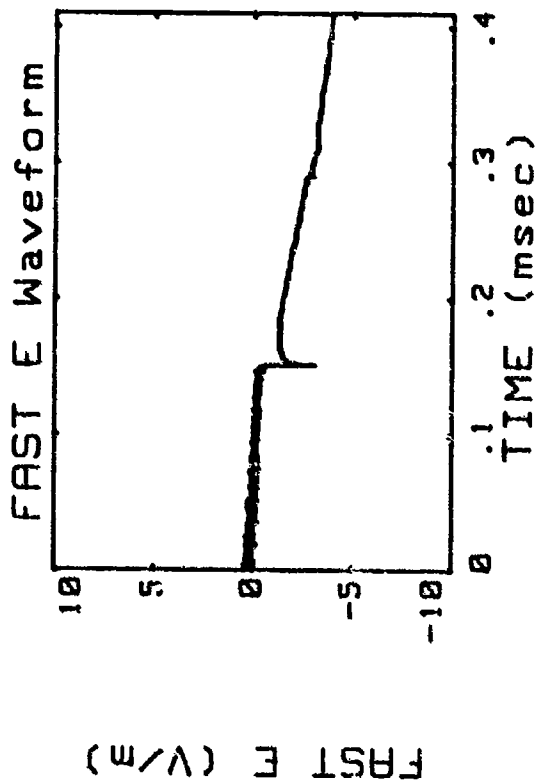


SLOW HF Waveform

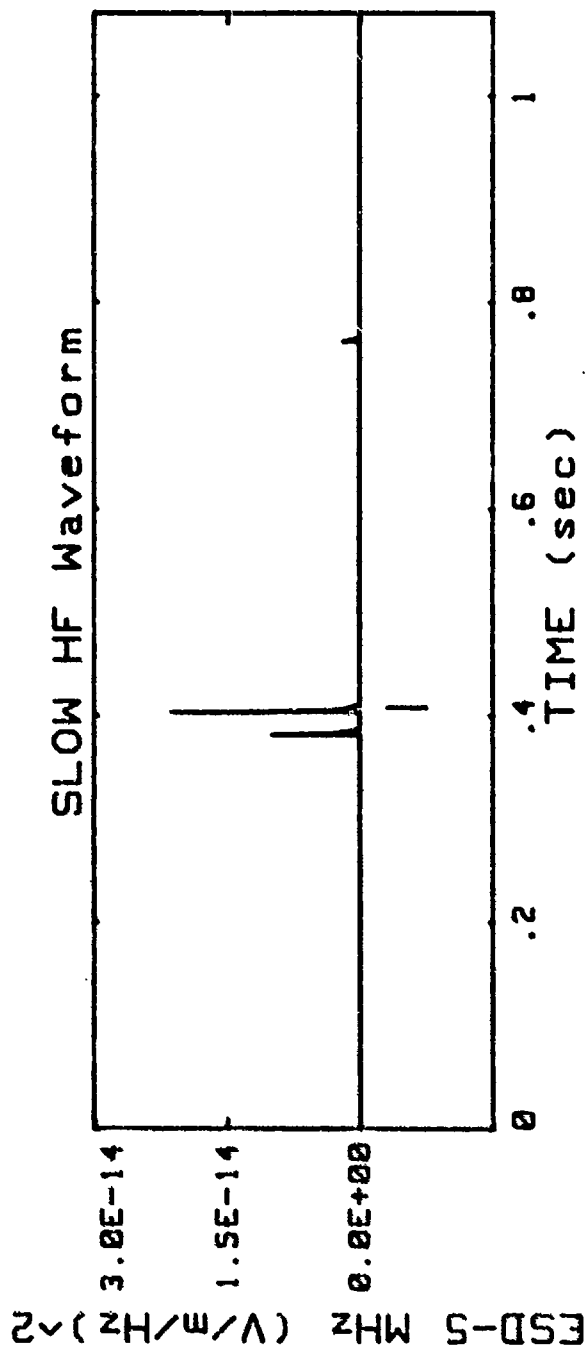
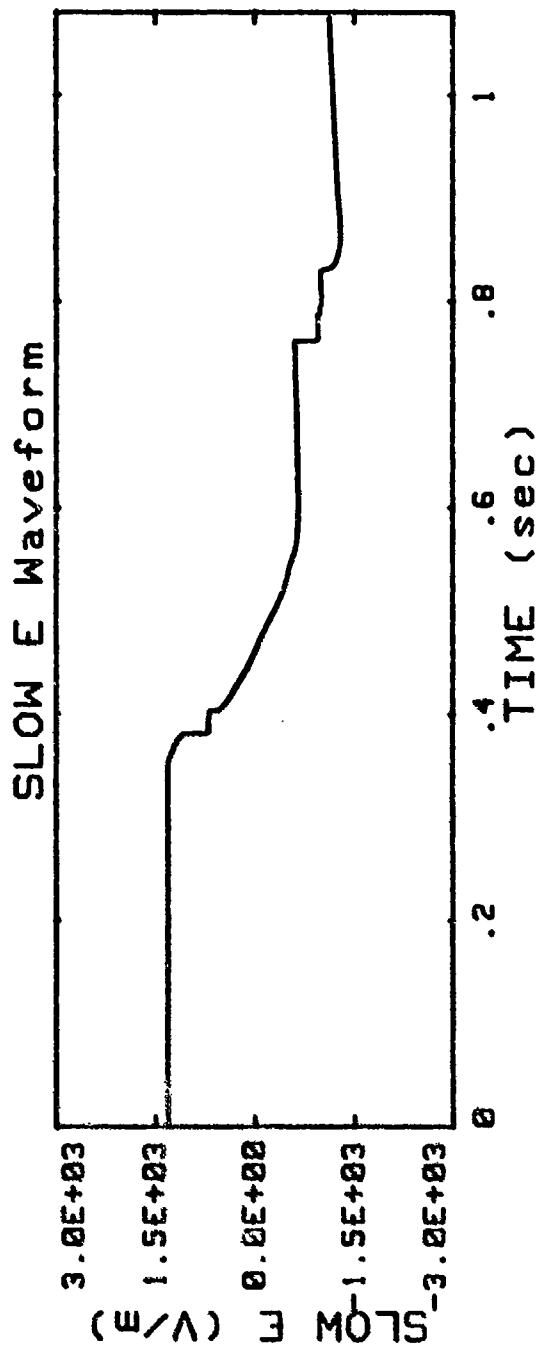


222165255.649 1985

Norm Subs RS (9.8 Km)

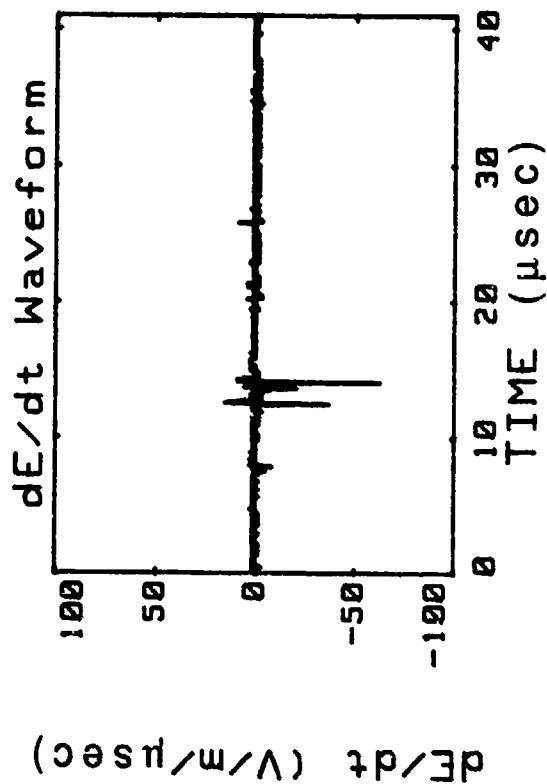
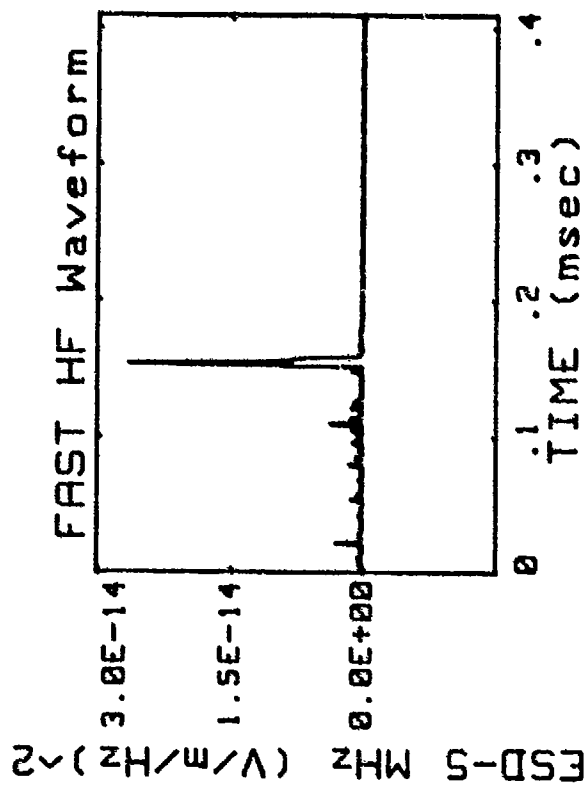
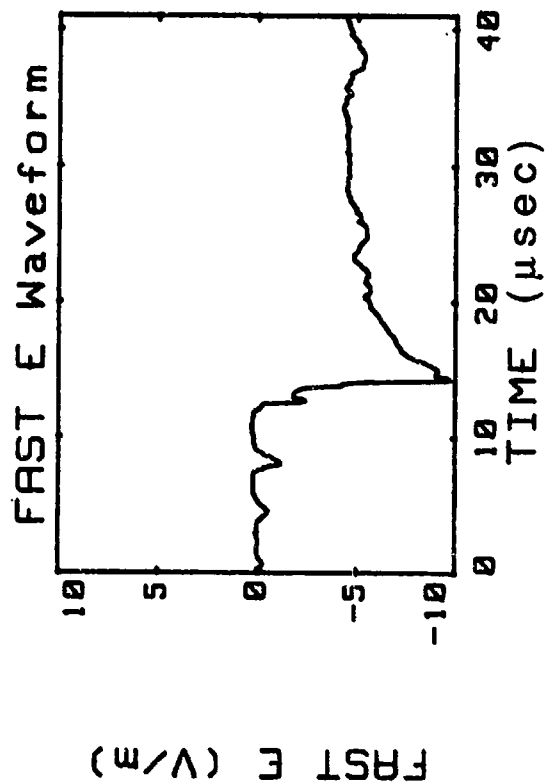
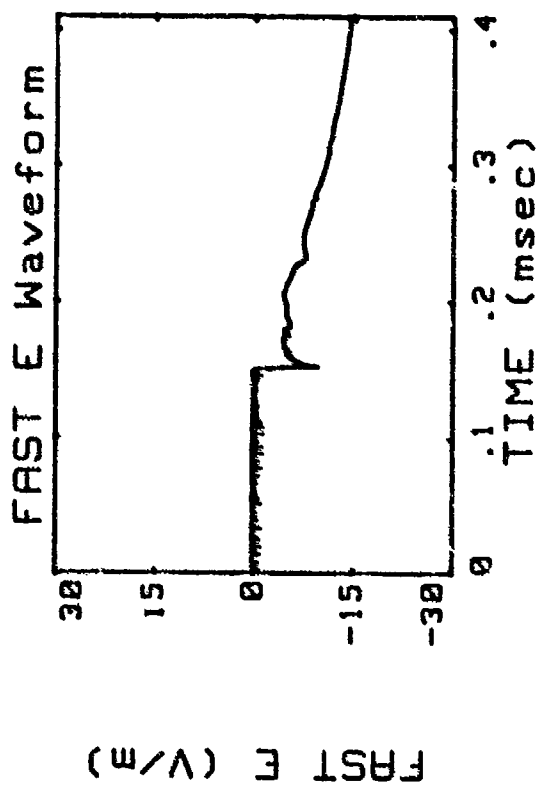


16:52:55.254 10 Aug 1985 (9.8 Km)

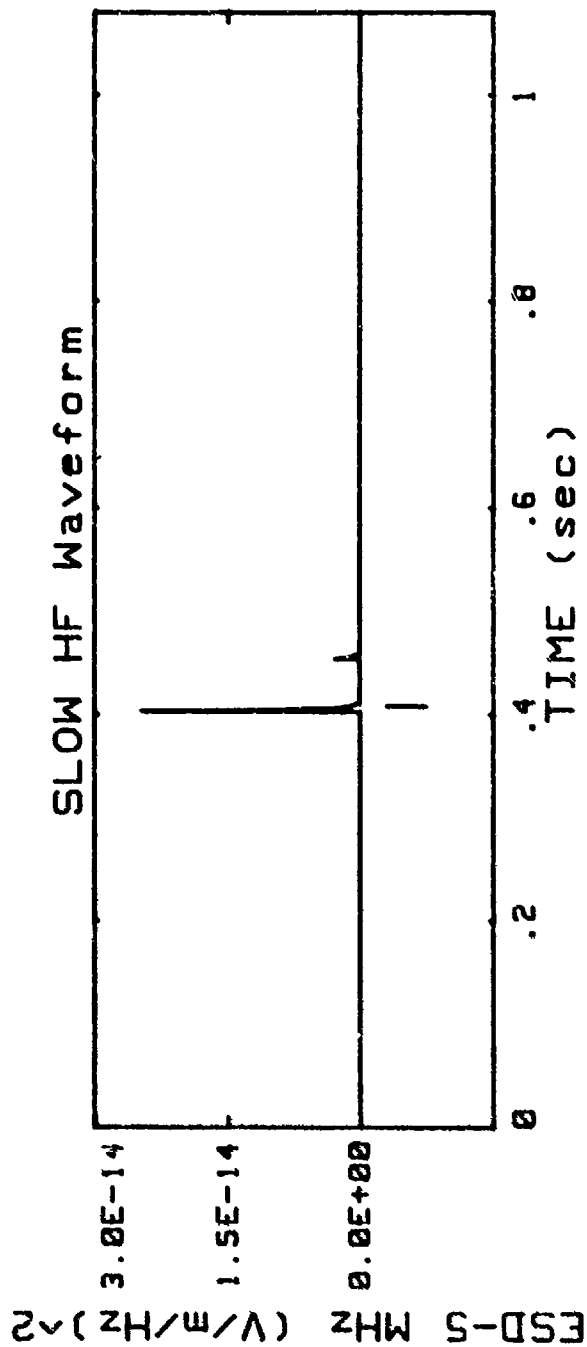
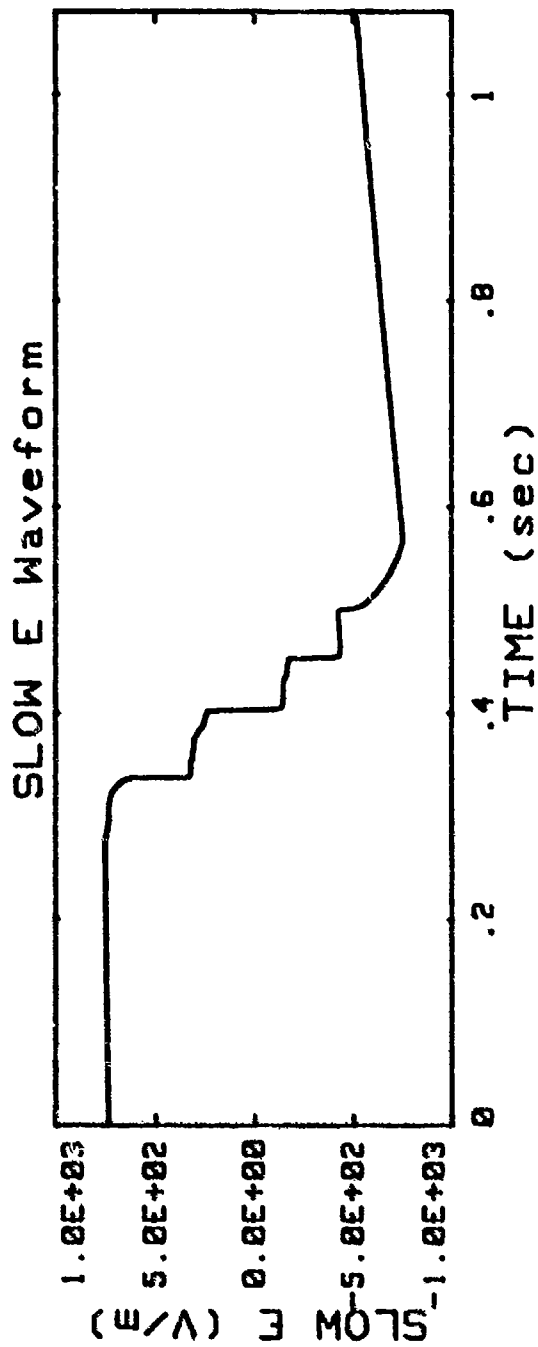


222165306.399 1985

DS Subs RS (9.4 Km)

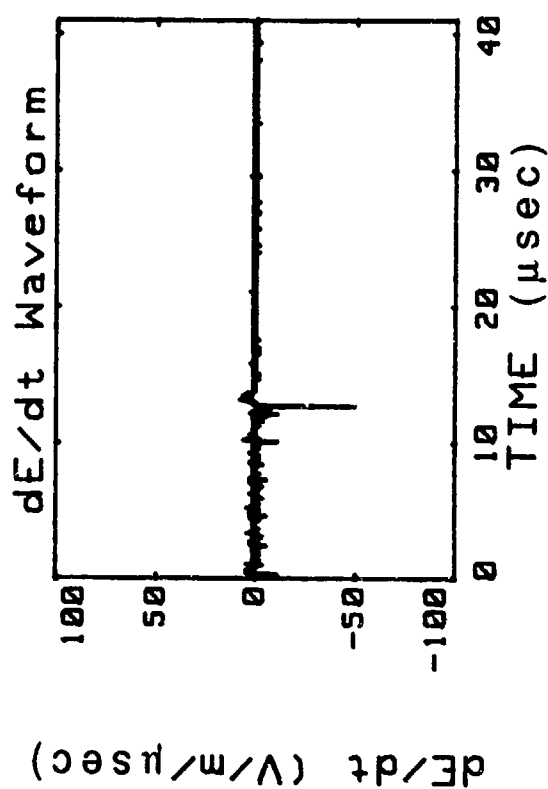
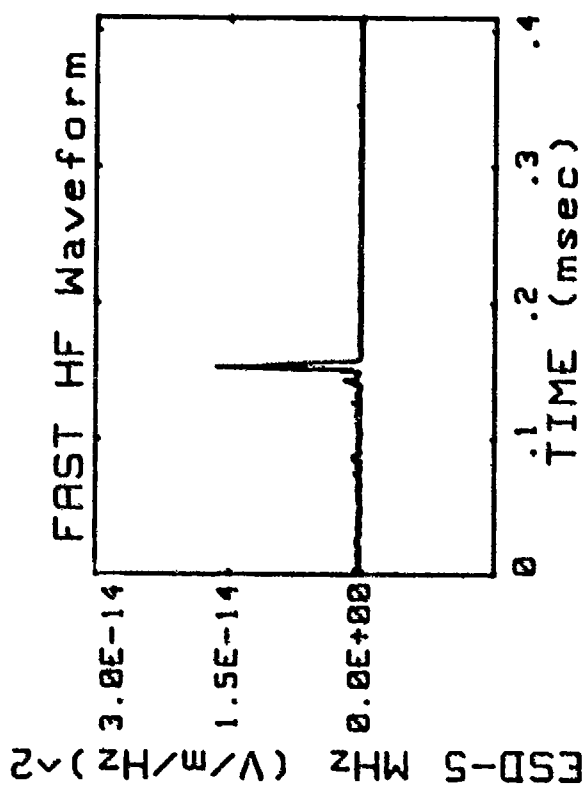
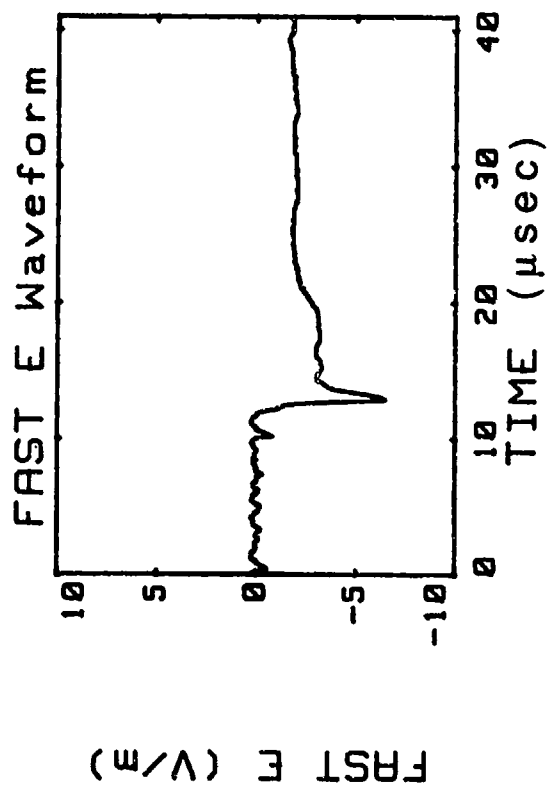
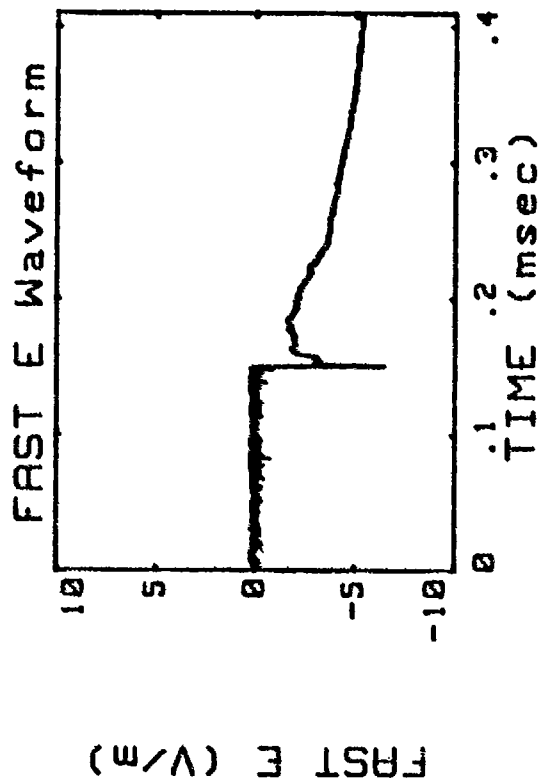


16:53:06.004 10 Aug 1985 (9.4 Km)



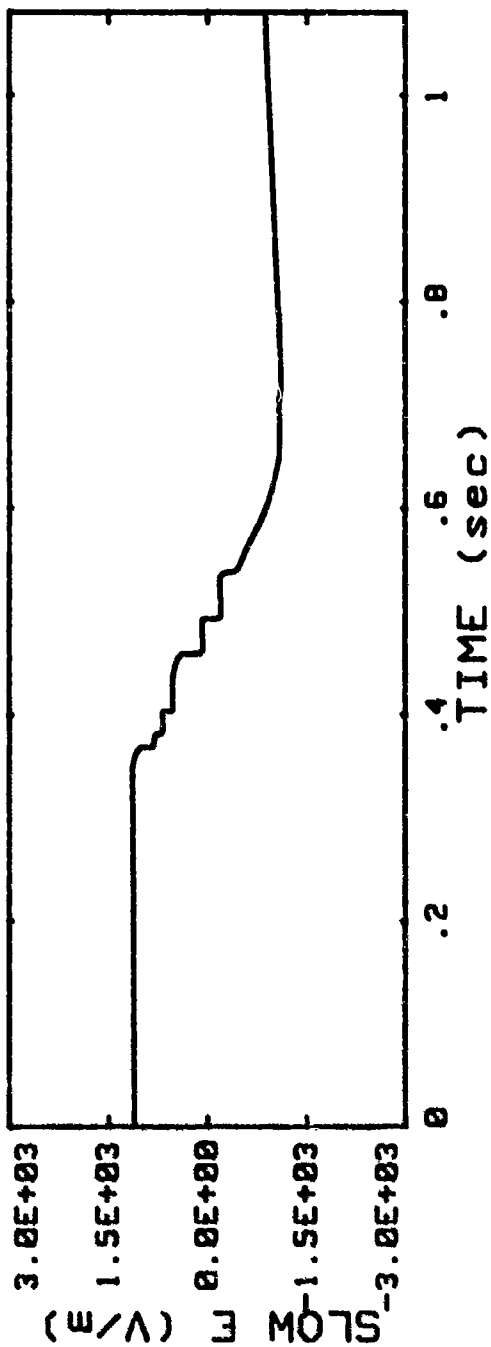
222165602.997 1985

DS Subs RS (10.4 Km)

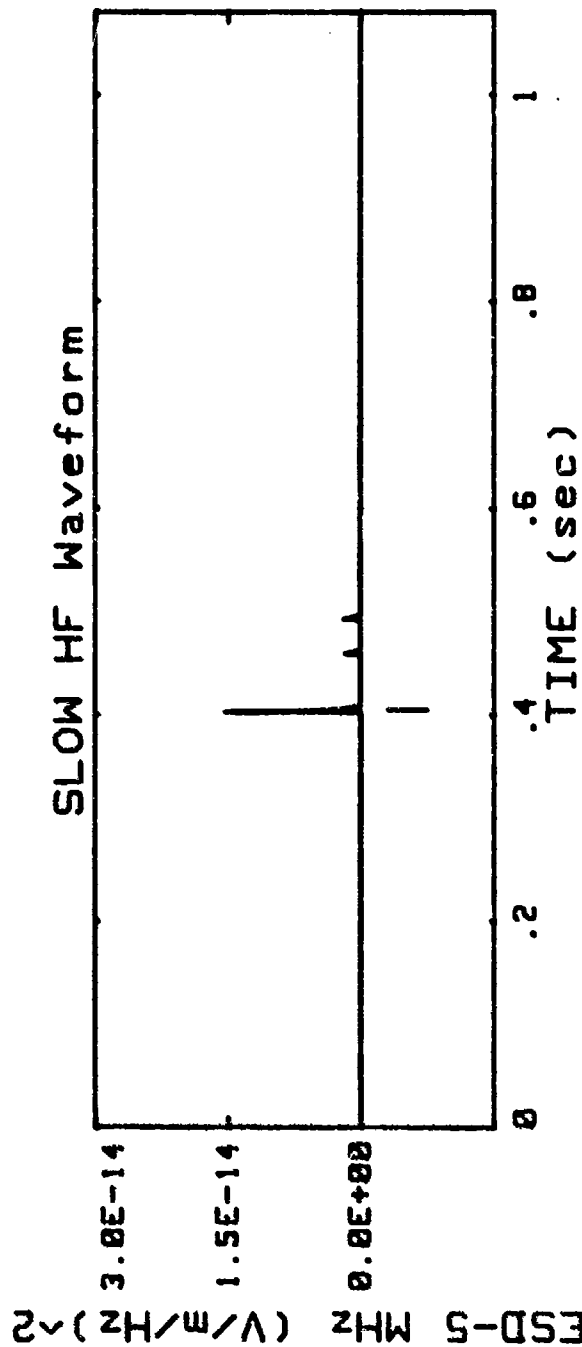


16:56:02.605 10 Aug 1985 (10.4 Km)

SLOW E Waveform

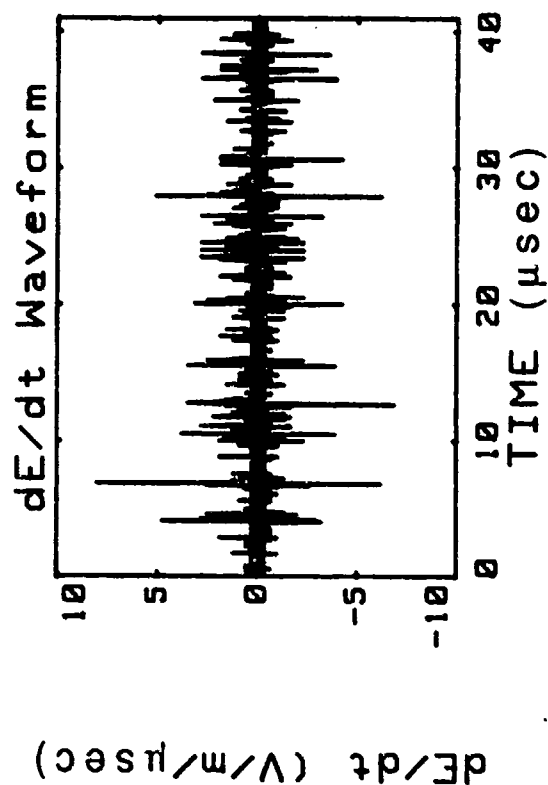
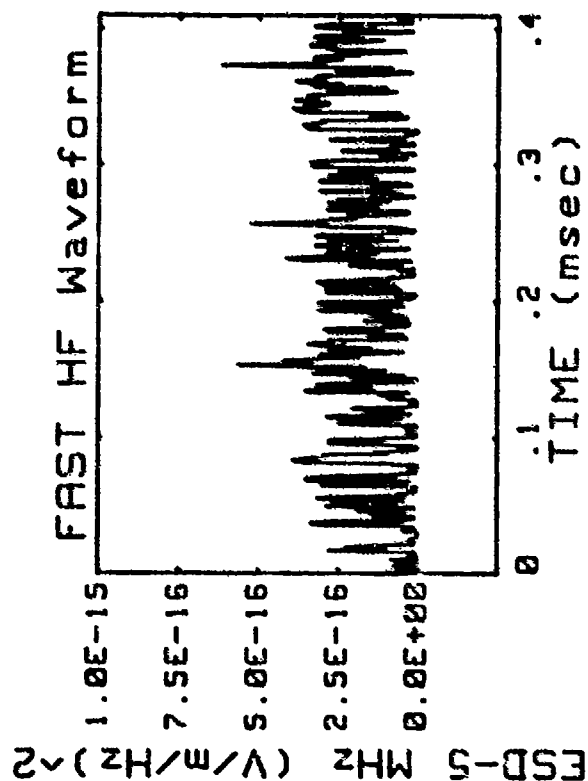
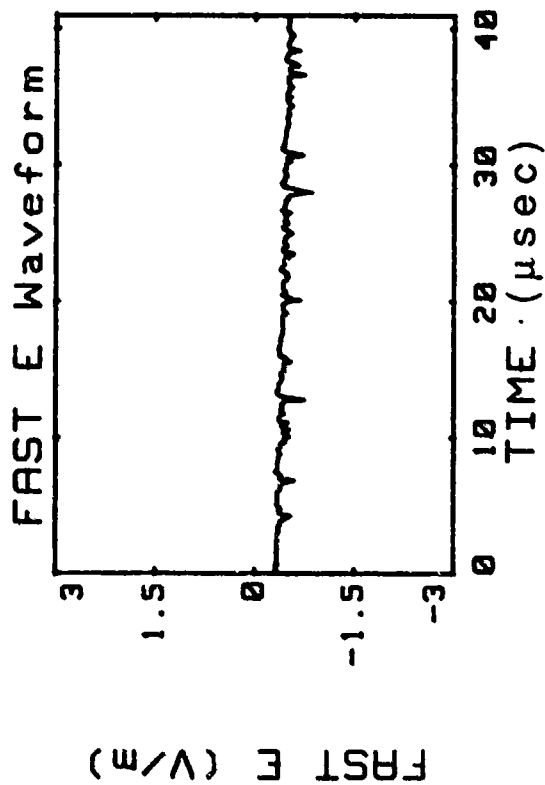
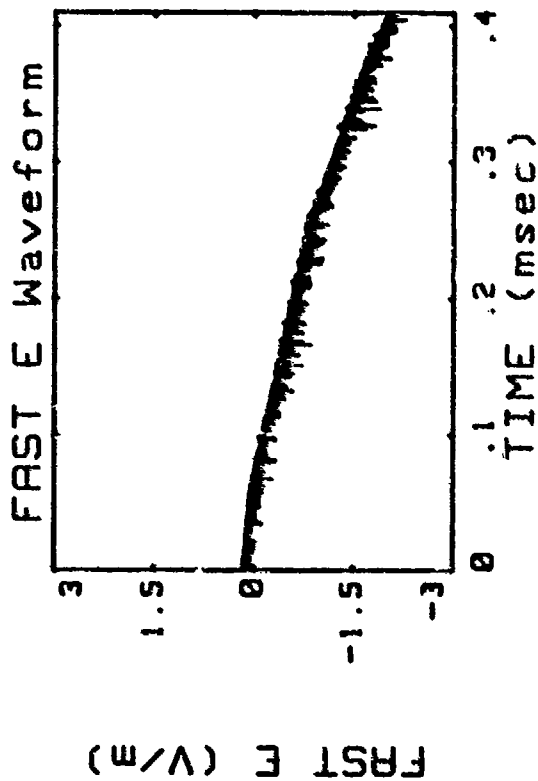


SLOW HF Waveform



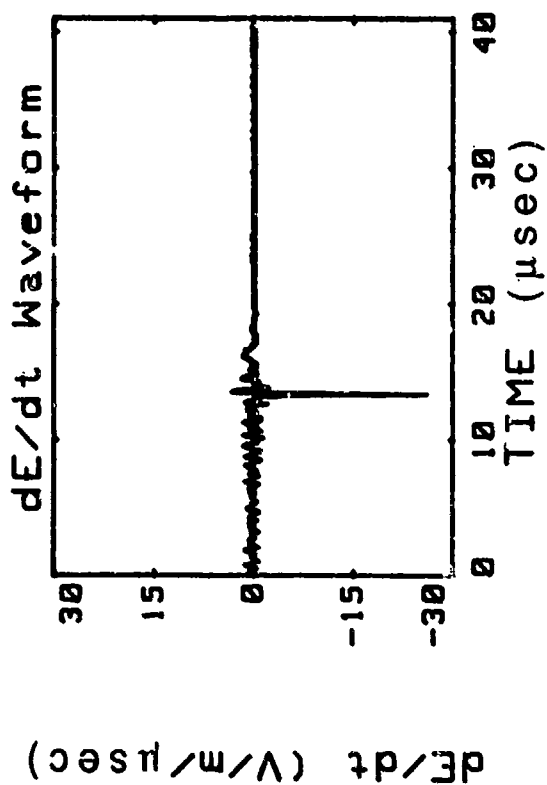
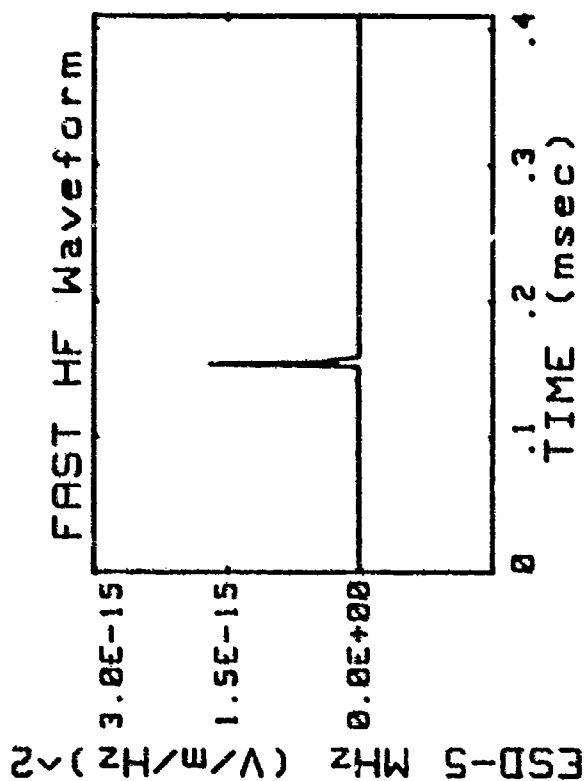
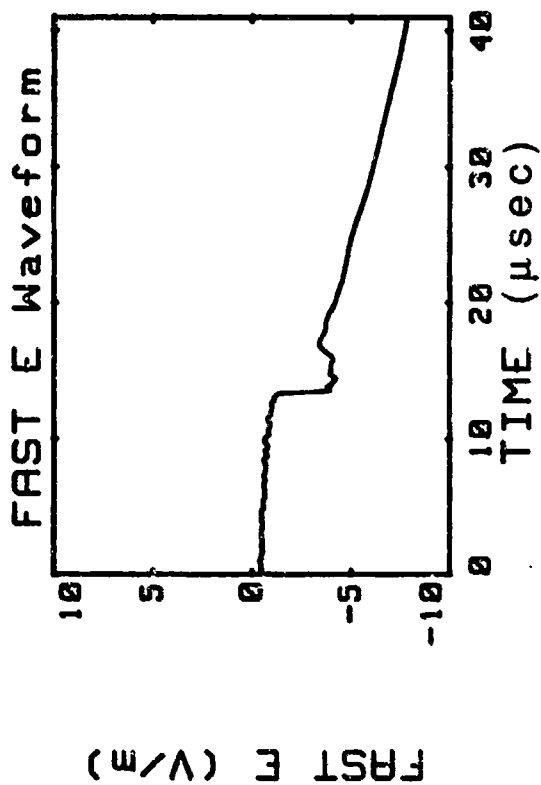
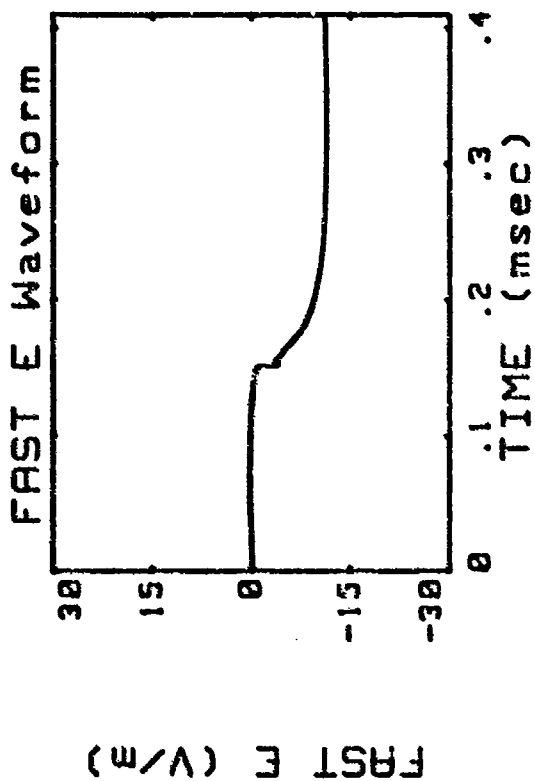
222170029.335 1985

Stepped Leader (1.9 Km)

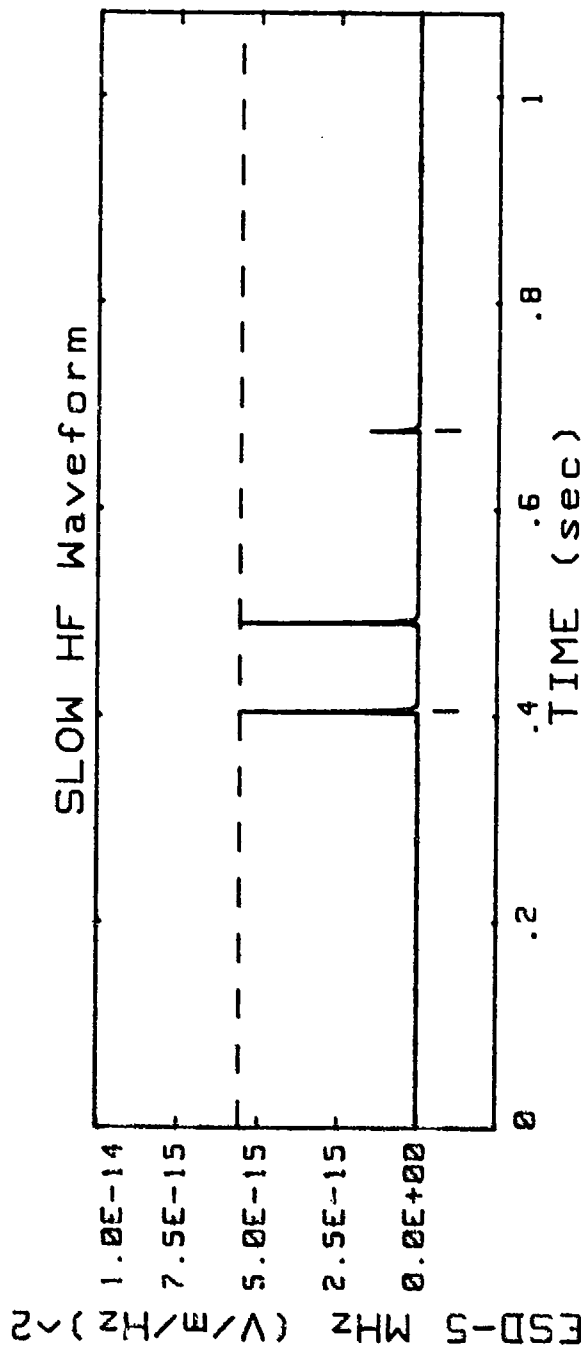
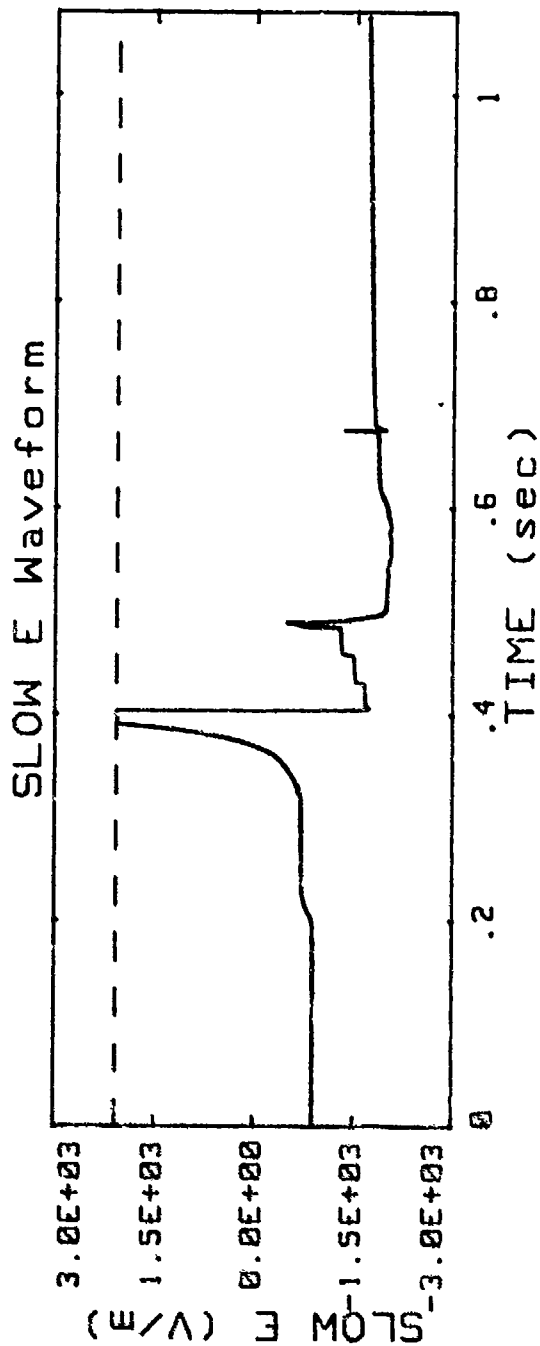


222170029.608 1985

Norm Subs RS (1.9 Km)

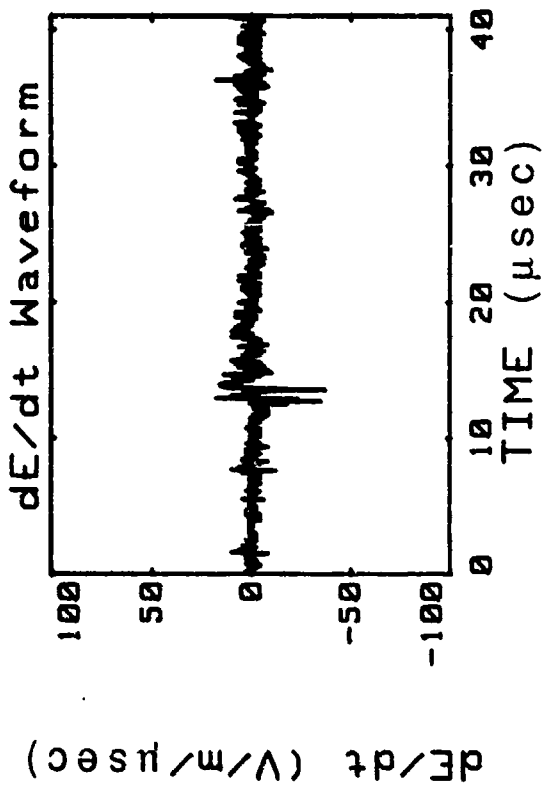
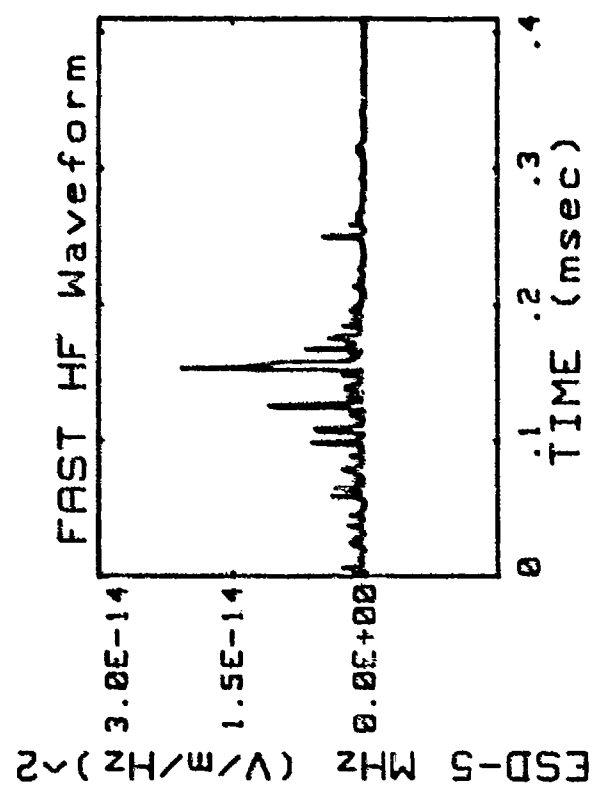
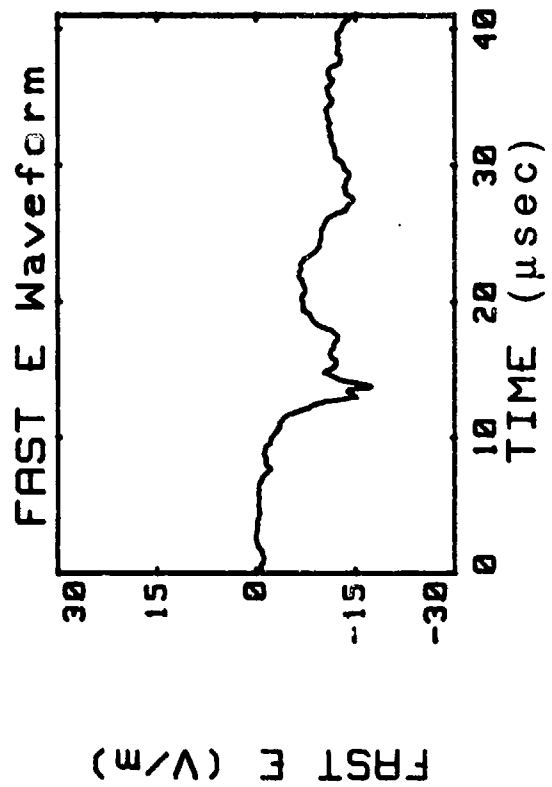
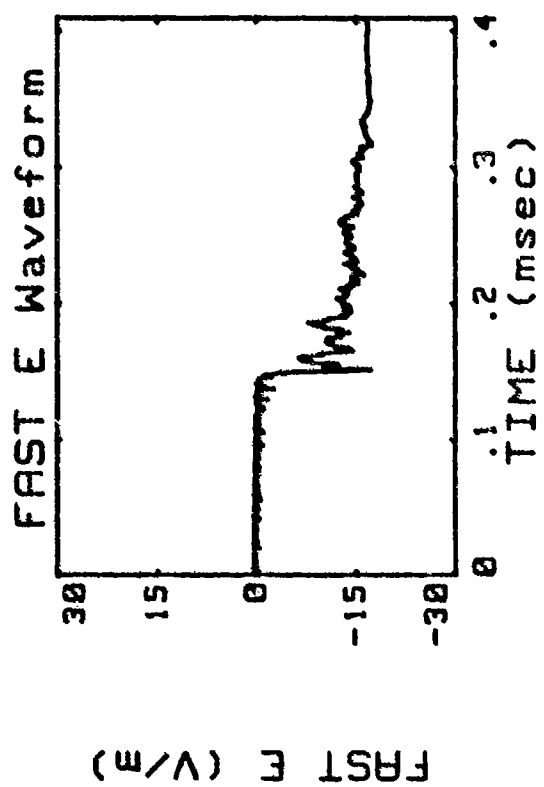


17:00:28.943 10 Aug 1985 (1.9 Km)

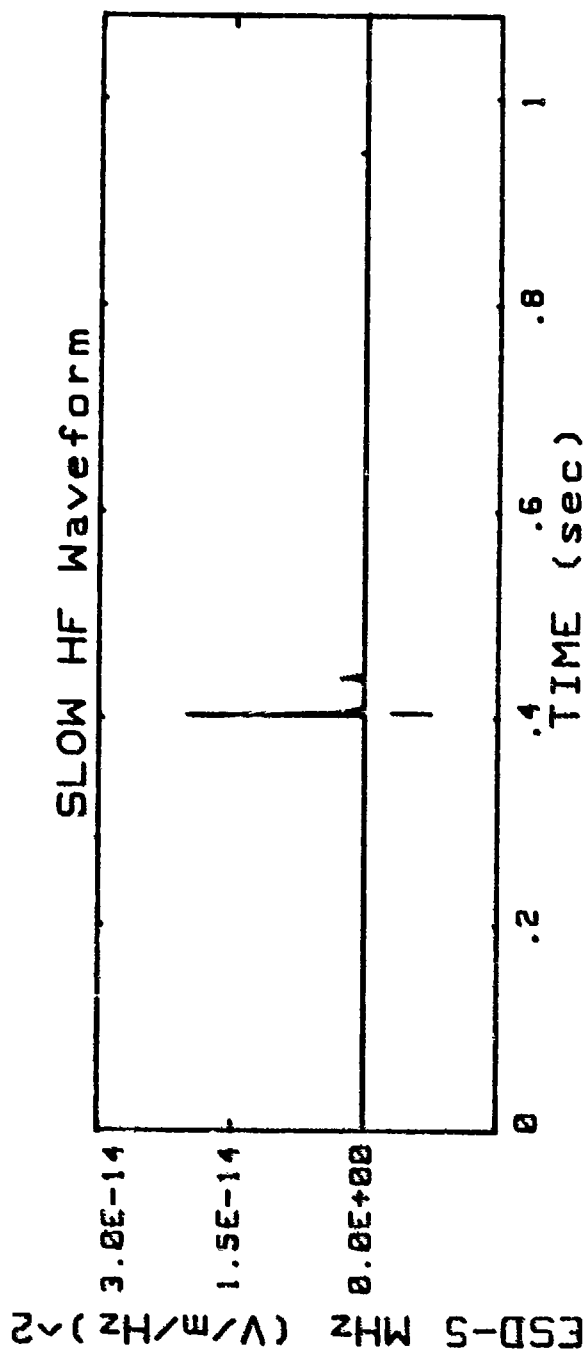
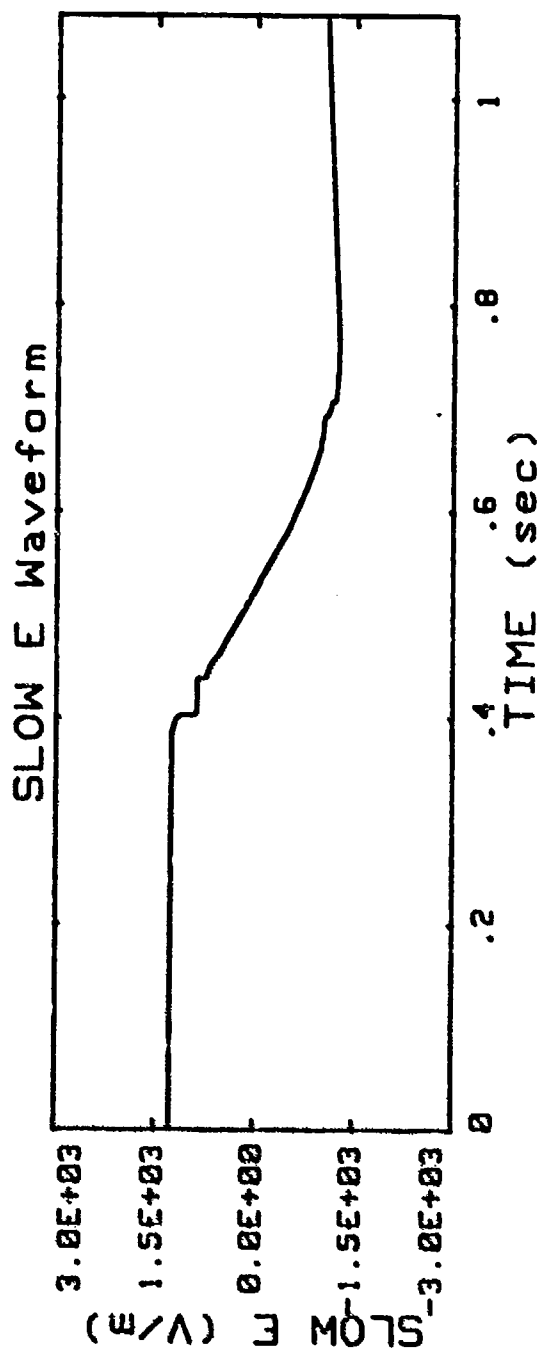


222170120.495 1985

1st RS (11.2 Km)

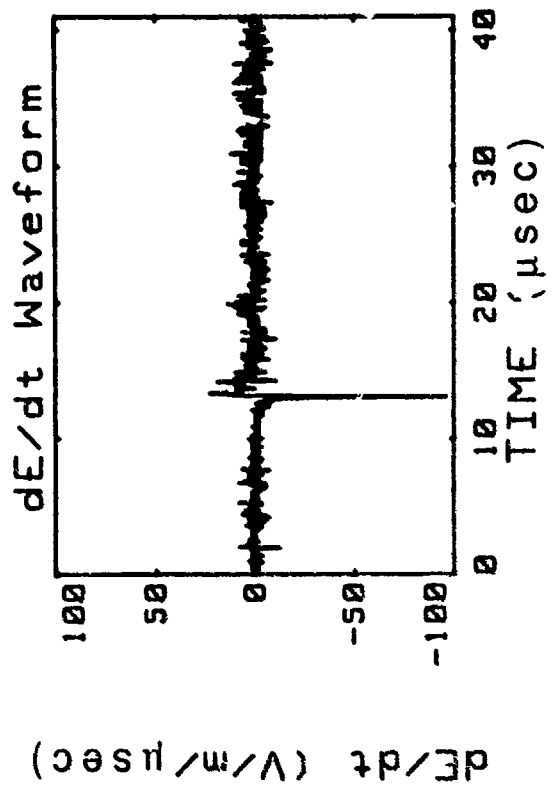
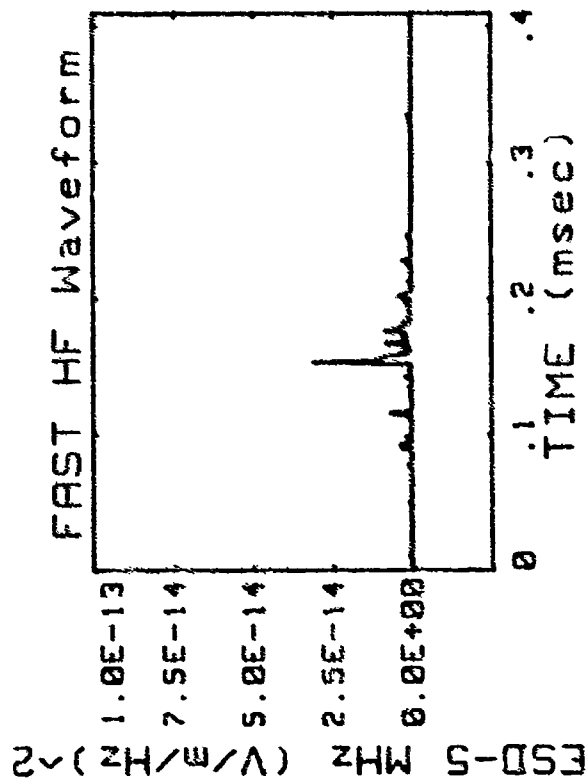
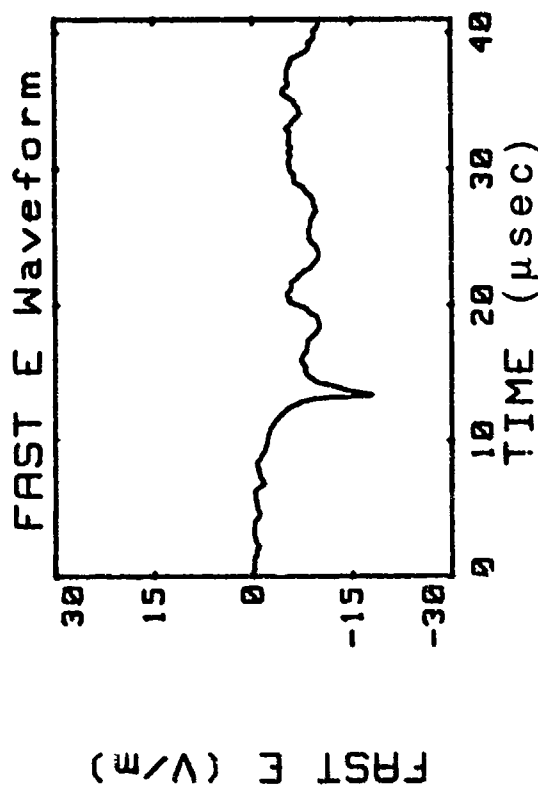
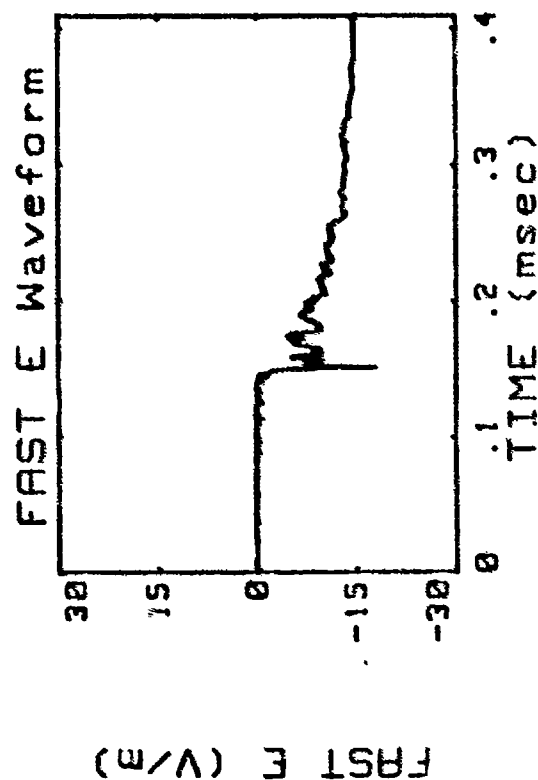


17:01:20.103 10 Aug 1985 (11.2 Km)

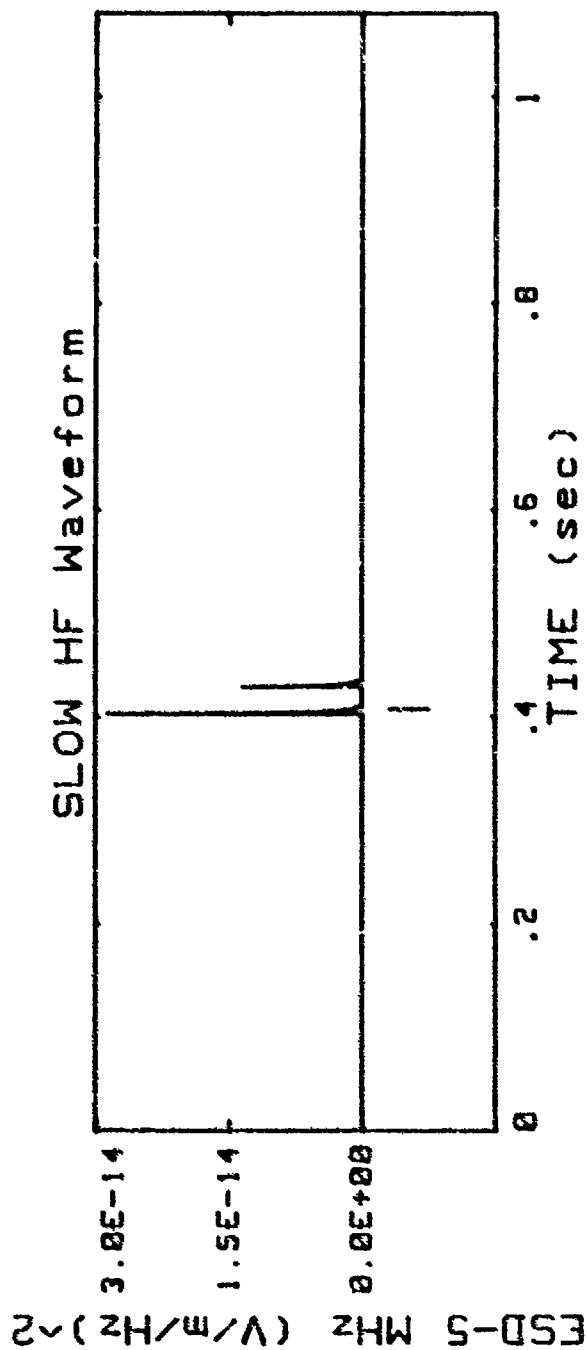
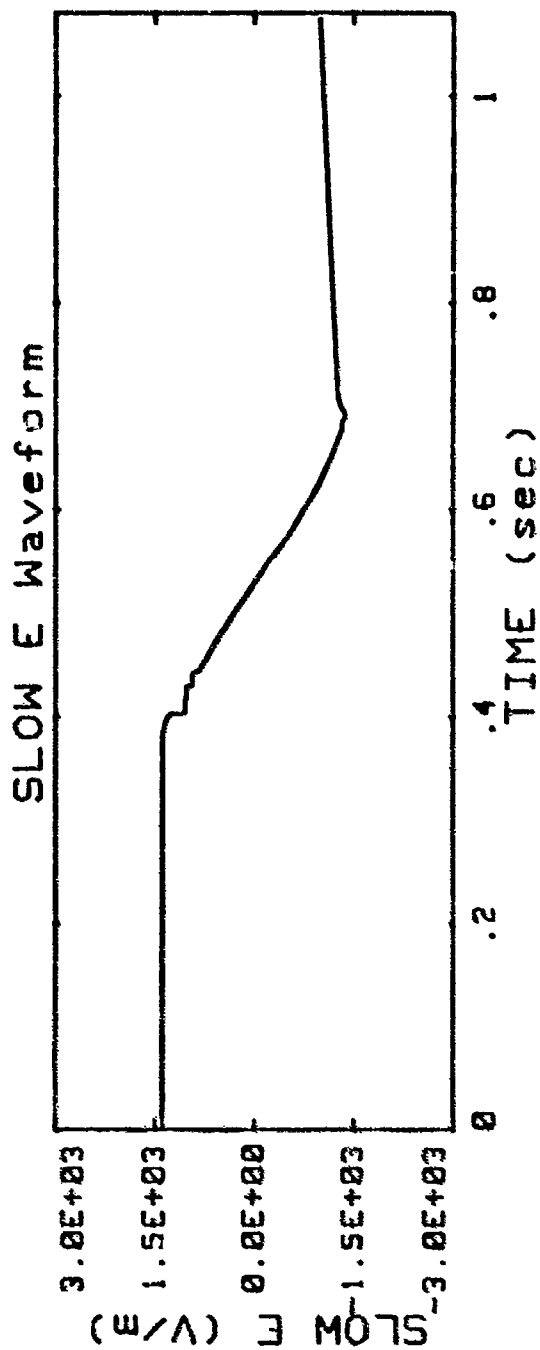


222170221.526 1985

1st RS (10.4 Km)

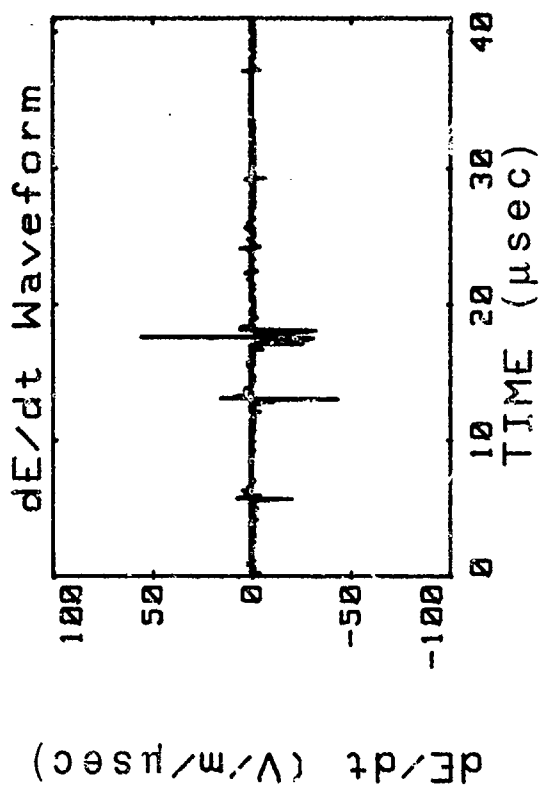
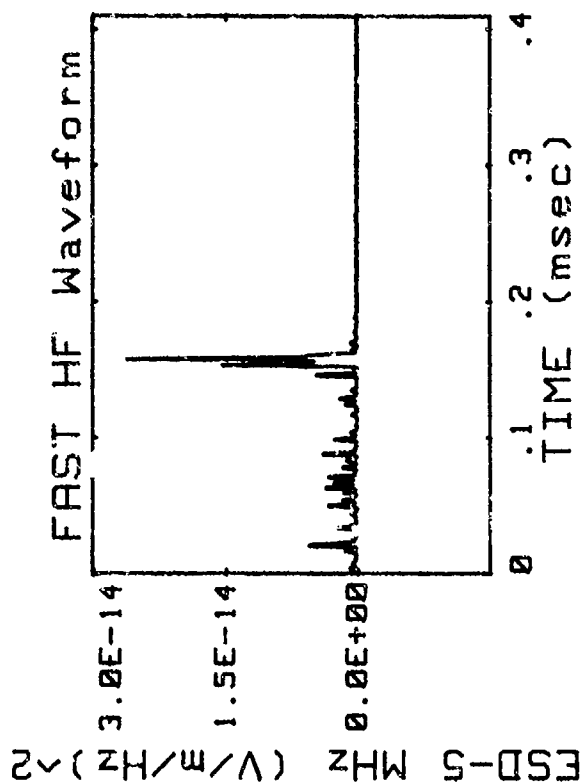
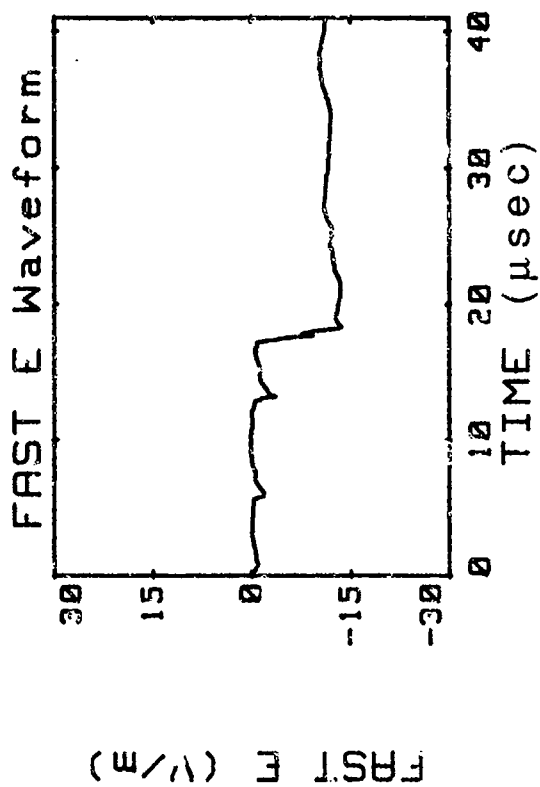
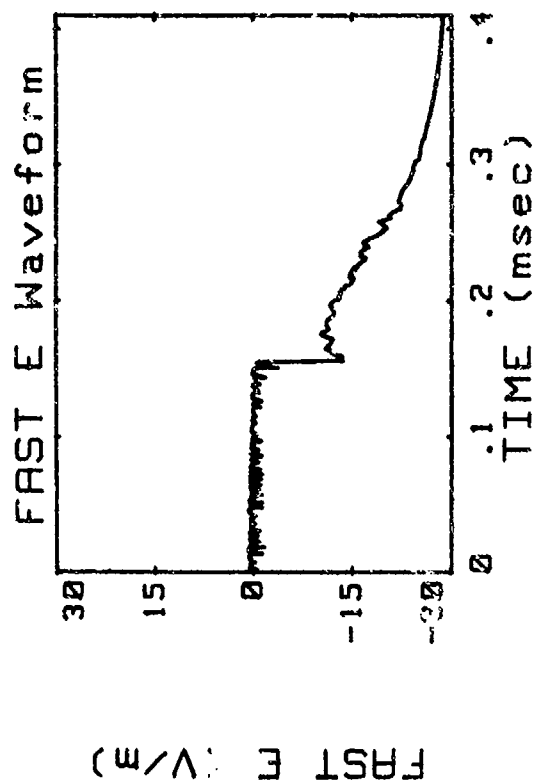


17:02:21.131 10 Aug 1985 (10.4 Km)

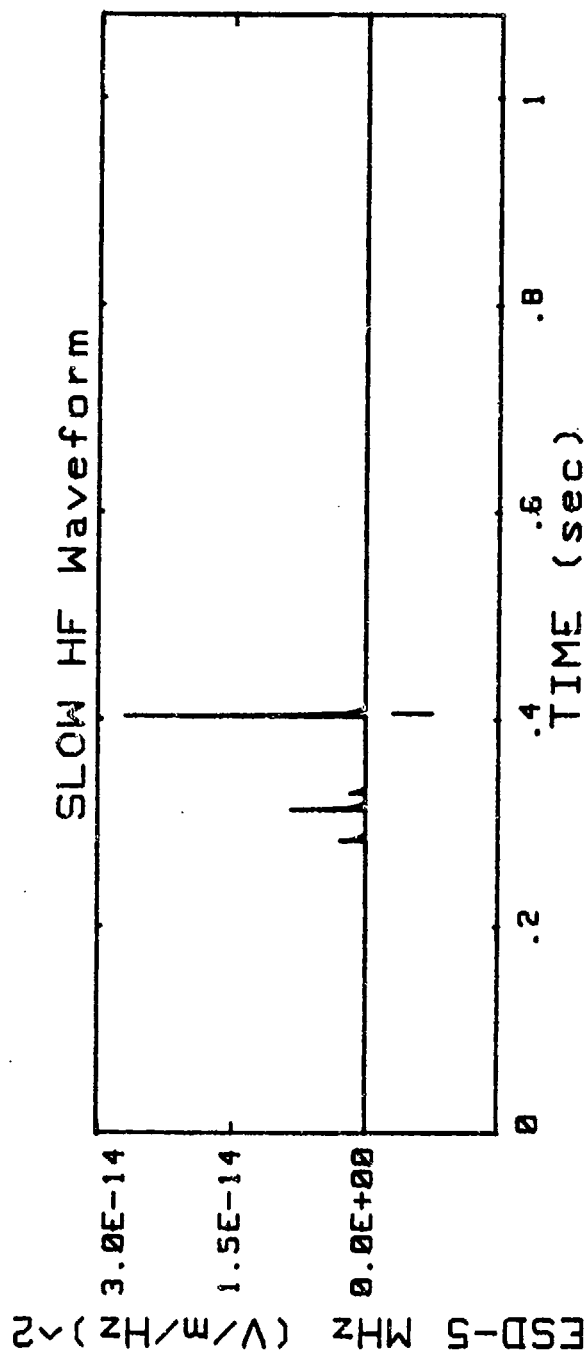
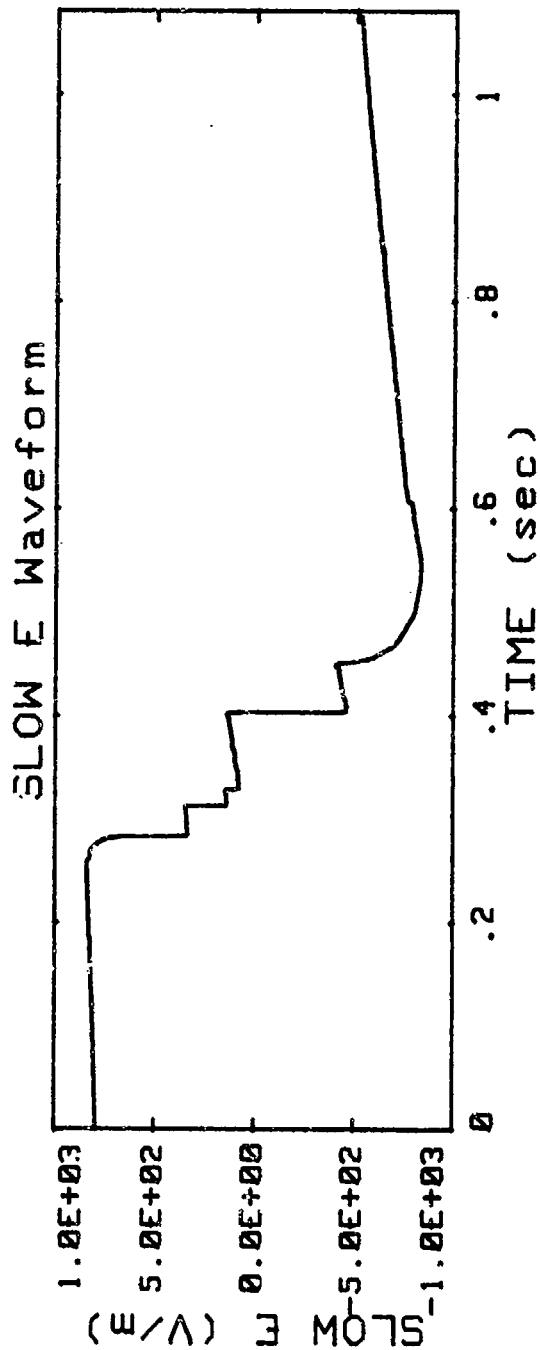


222170242.153 1985

DS Subs RS (7.9 Km)

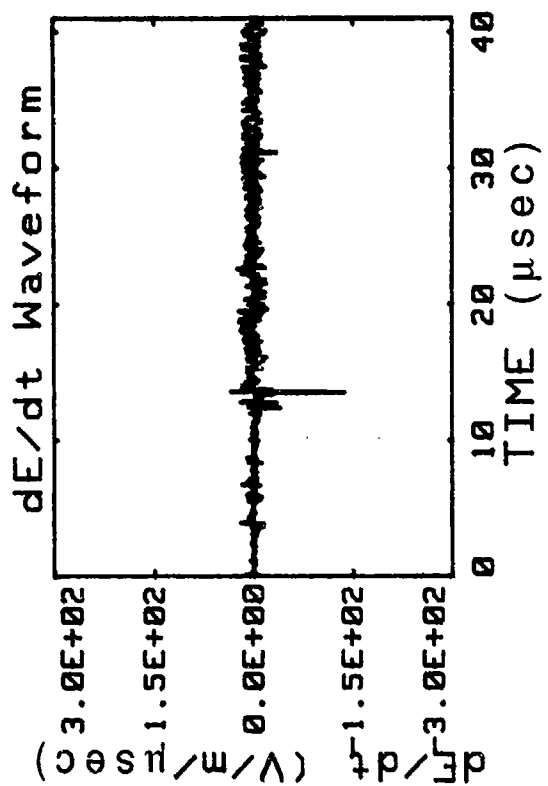
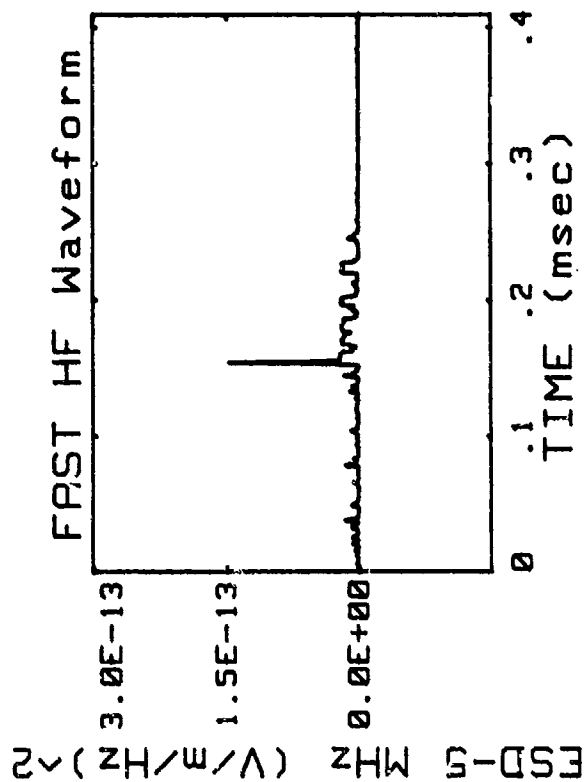
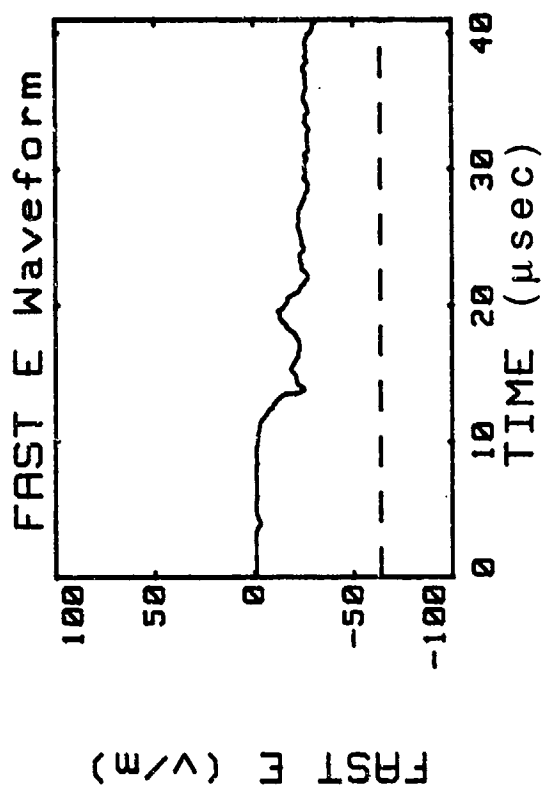
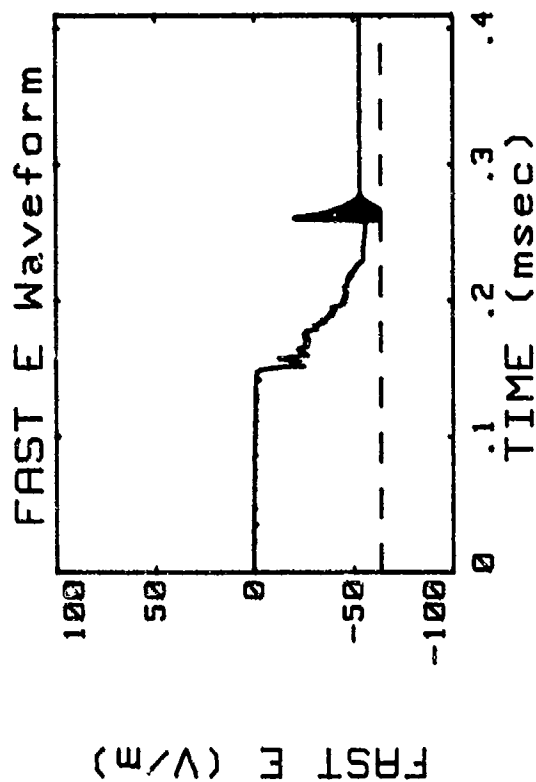


17:02:41.760 10 Aug 1985 (7.9 Km)

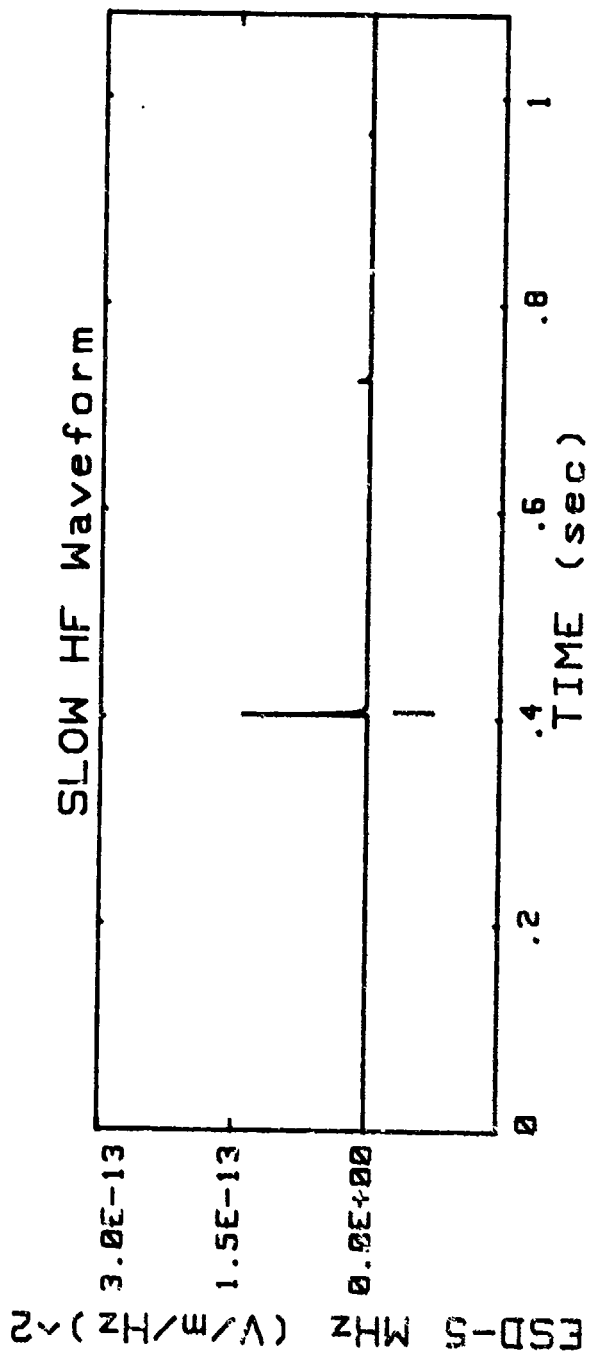
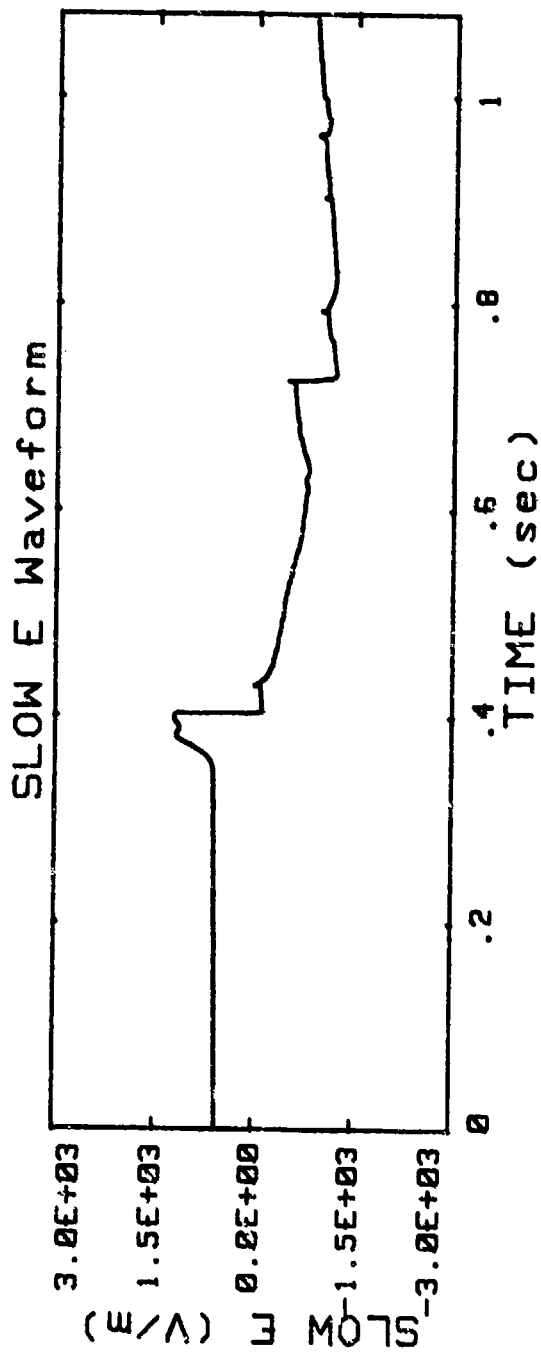


222170427.414 1985

1st RS (14.4 Km)

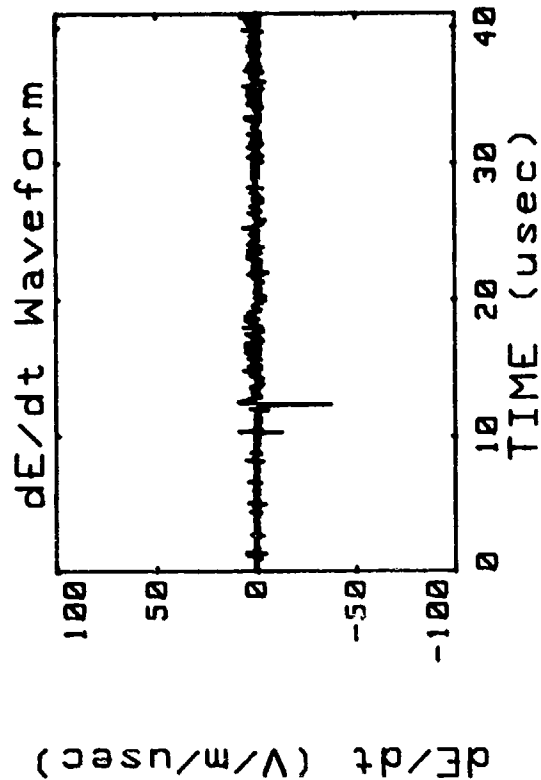
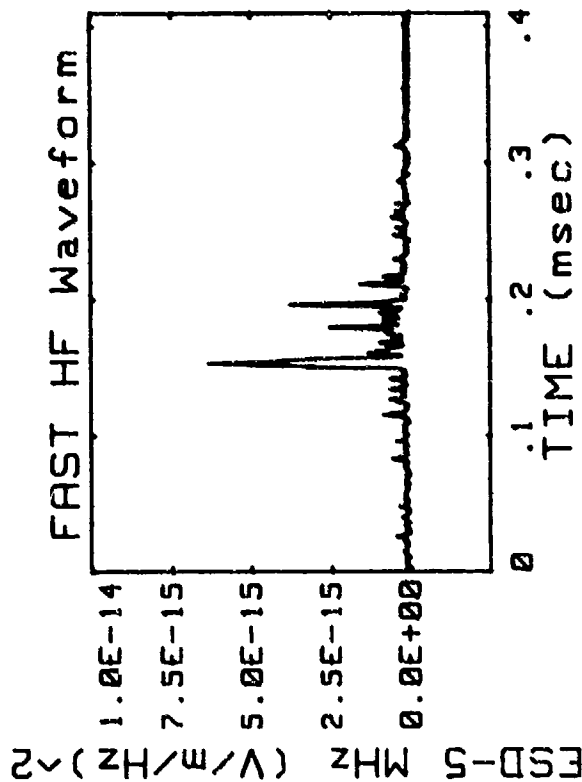
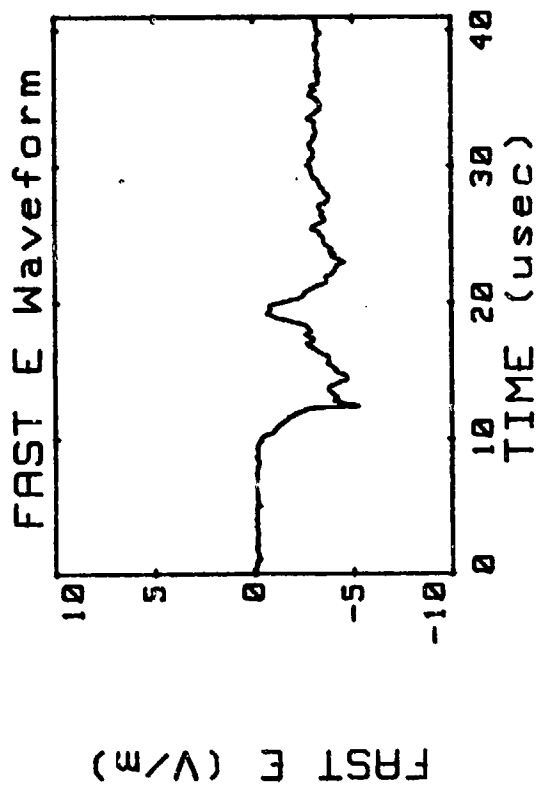
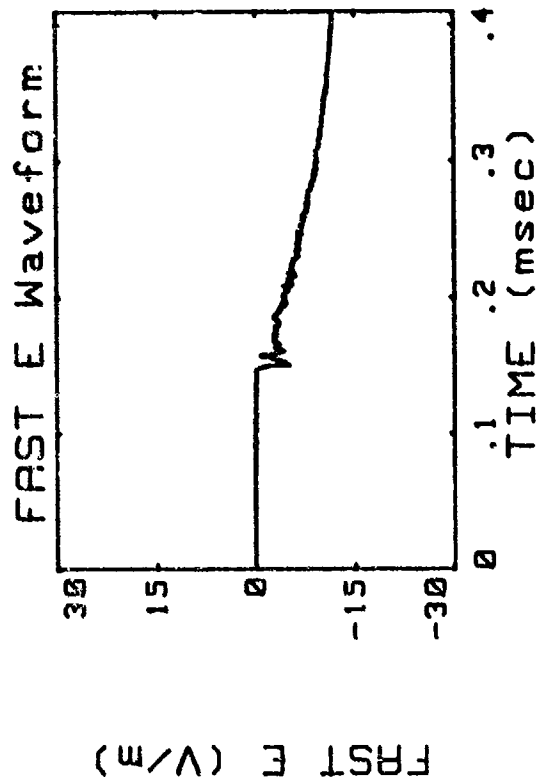


17:04:27.021 10 Aug 1985 (14.4 Km)

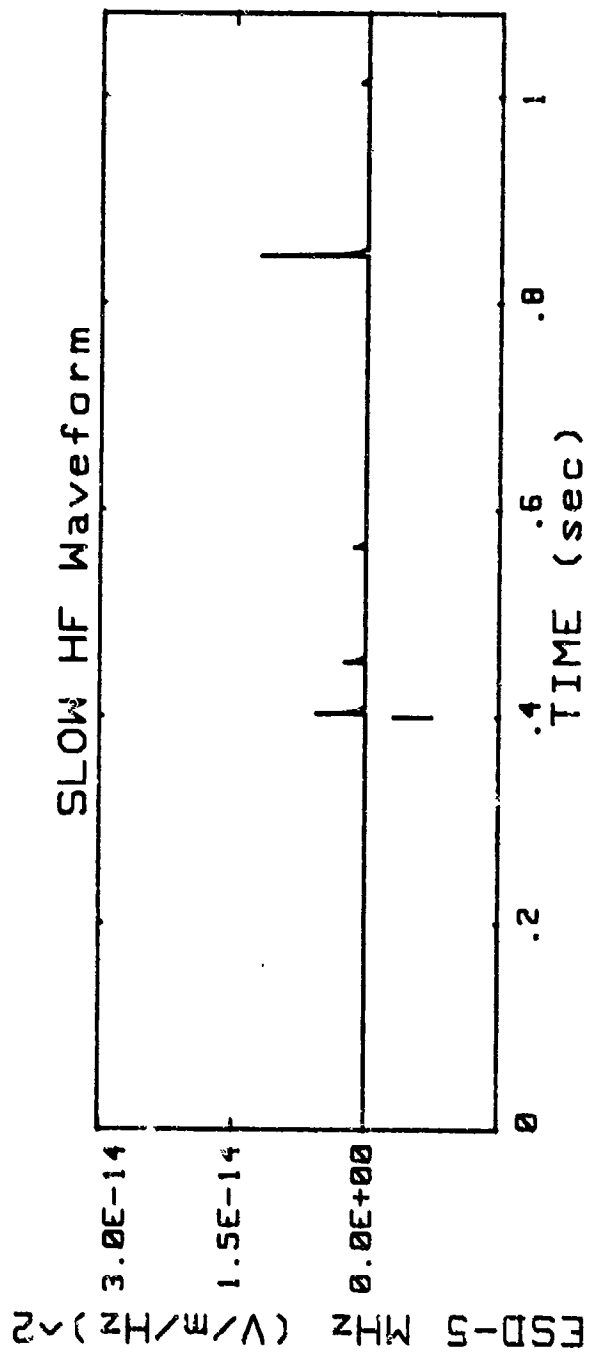
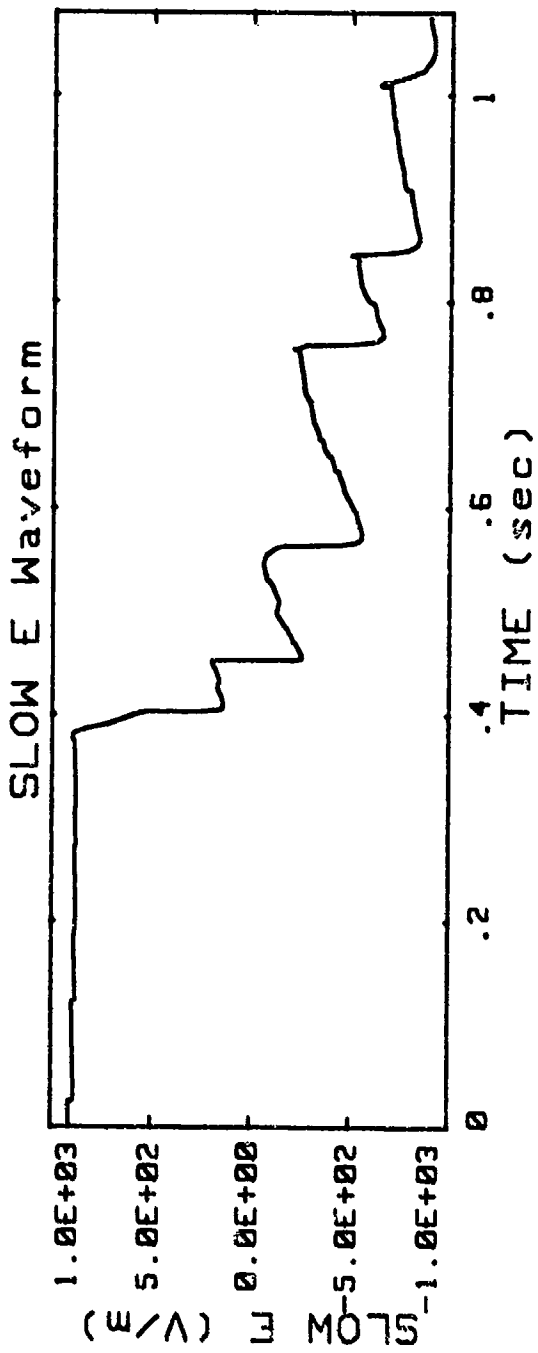


222170502.960 1985

1st RS (6.9 Km)

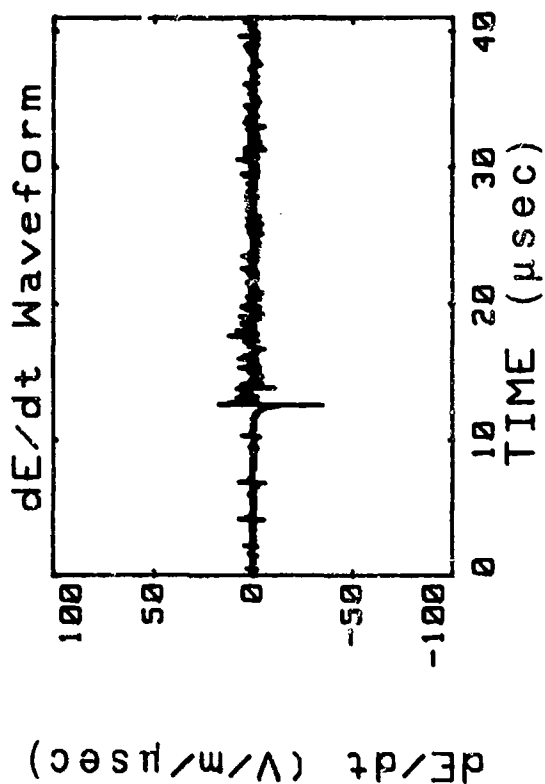
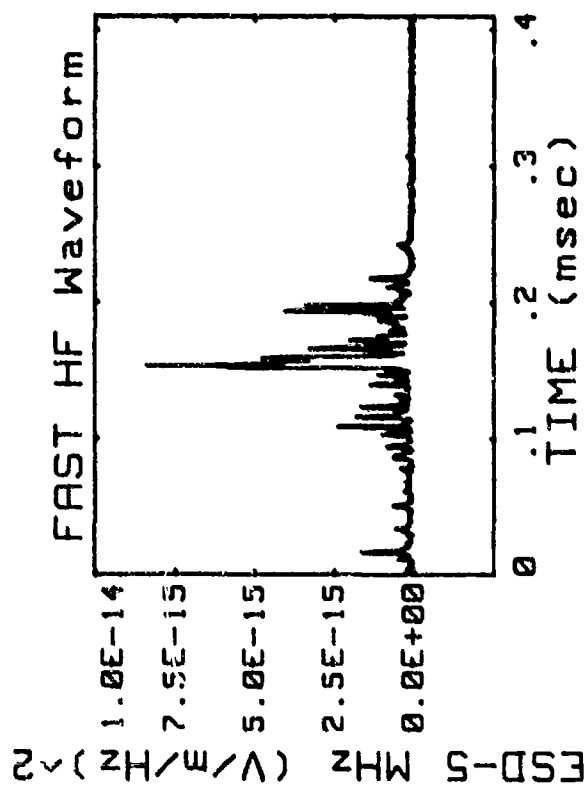
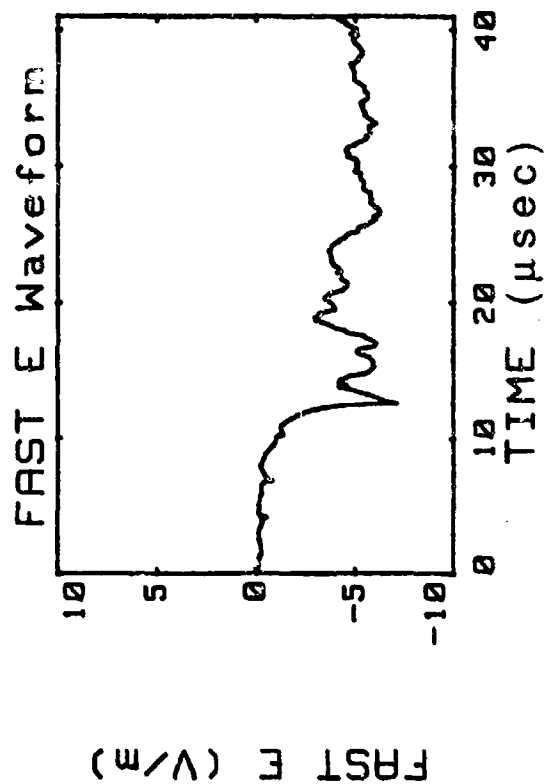
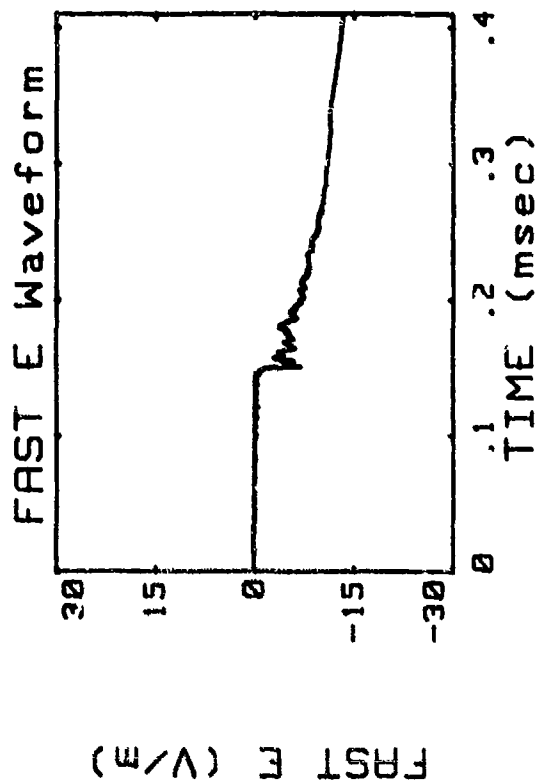


17:05:02.573 10 Aug 1985 (6.9 Km)

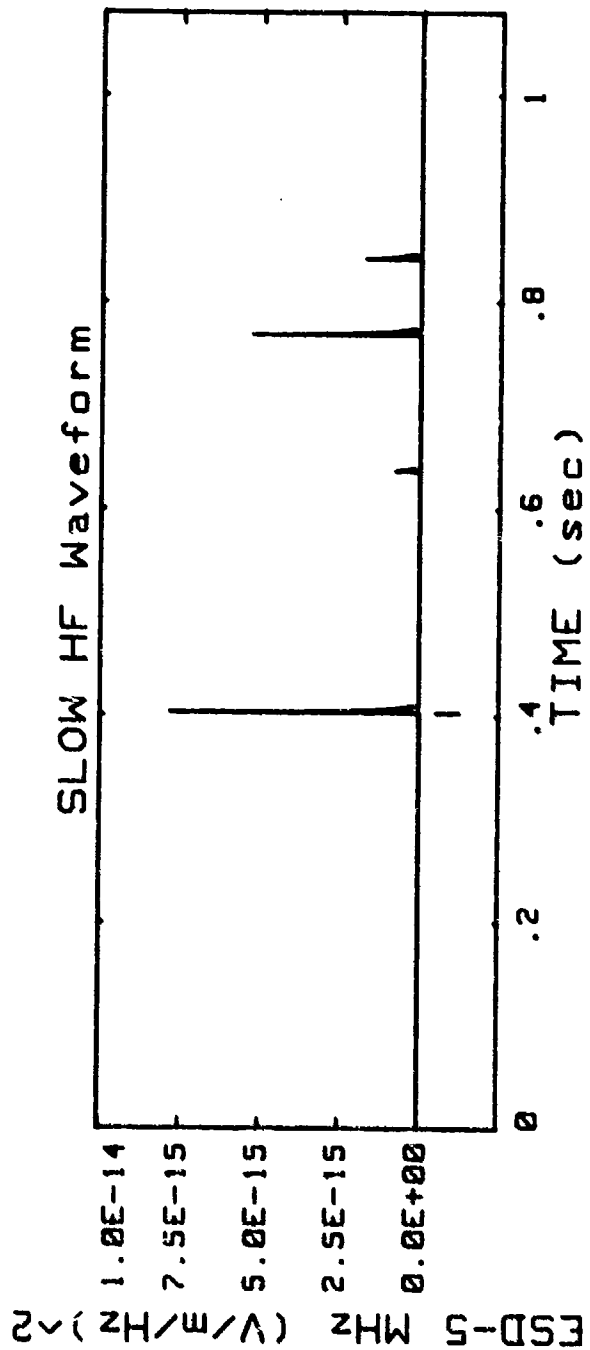
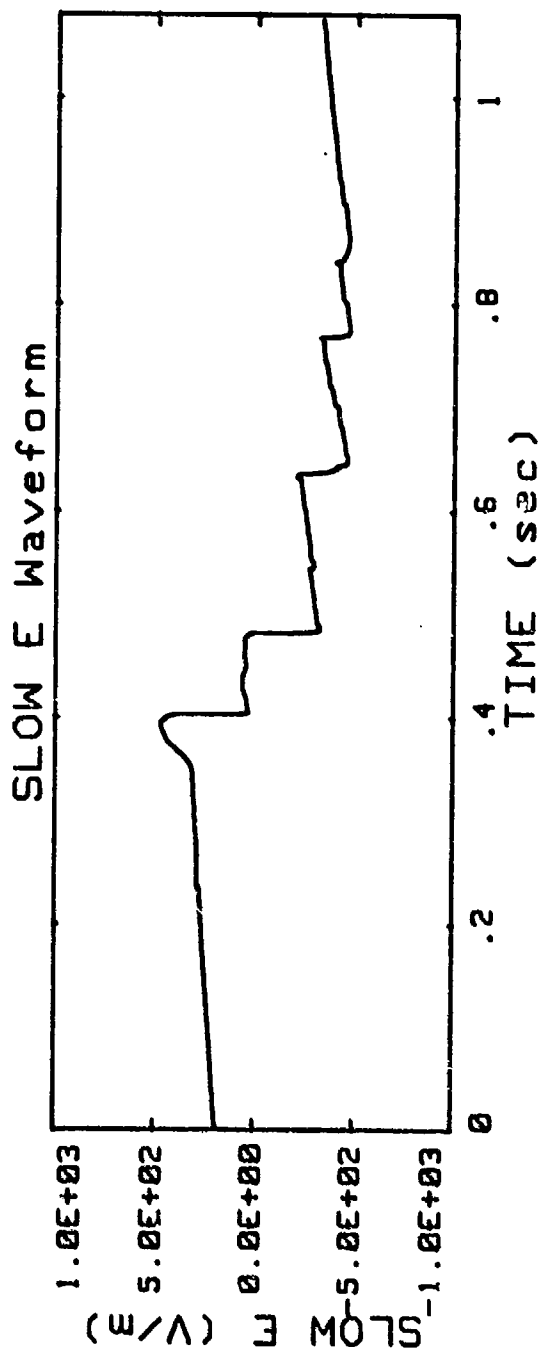


222170621.626 1985

1st RS (7.4 Km)

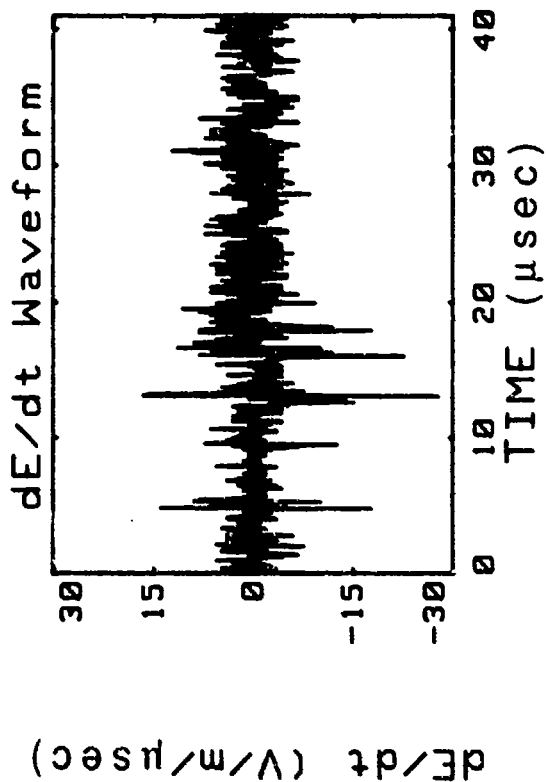
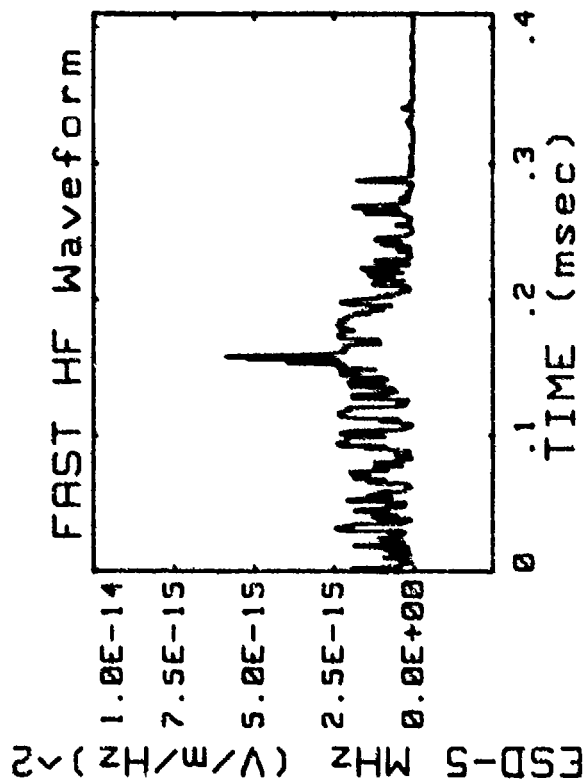
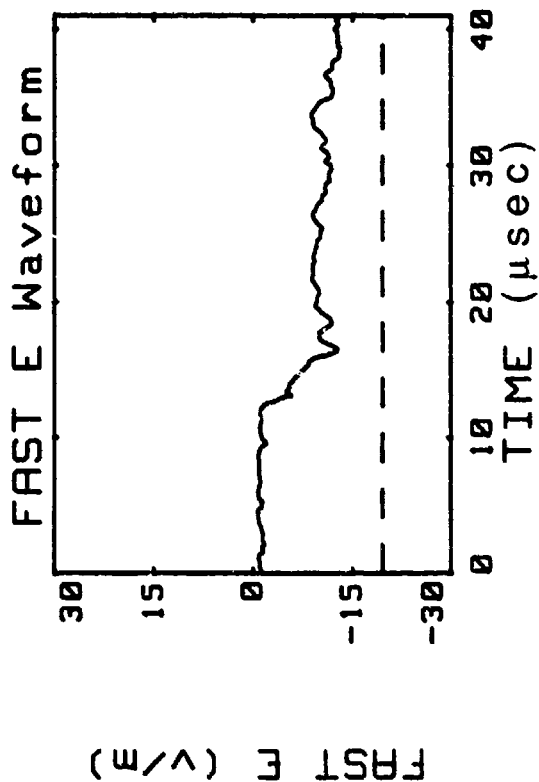
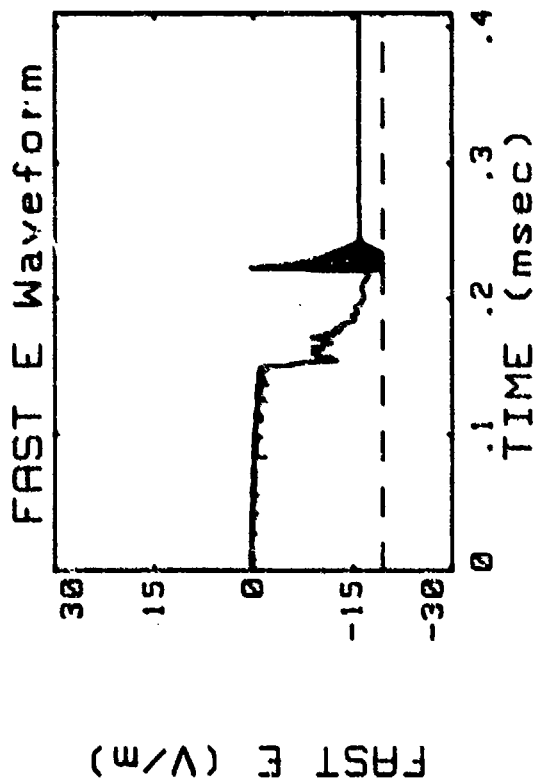


17:06:21.236 10 Aug 1985 (7.4 Km)

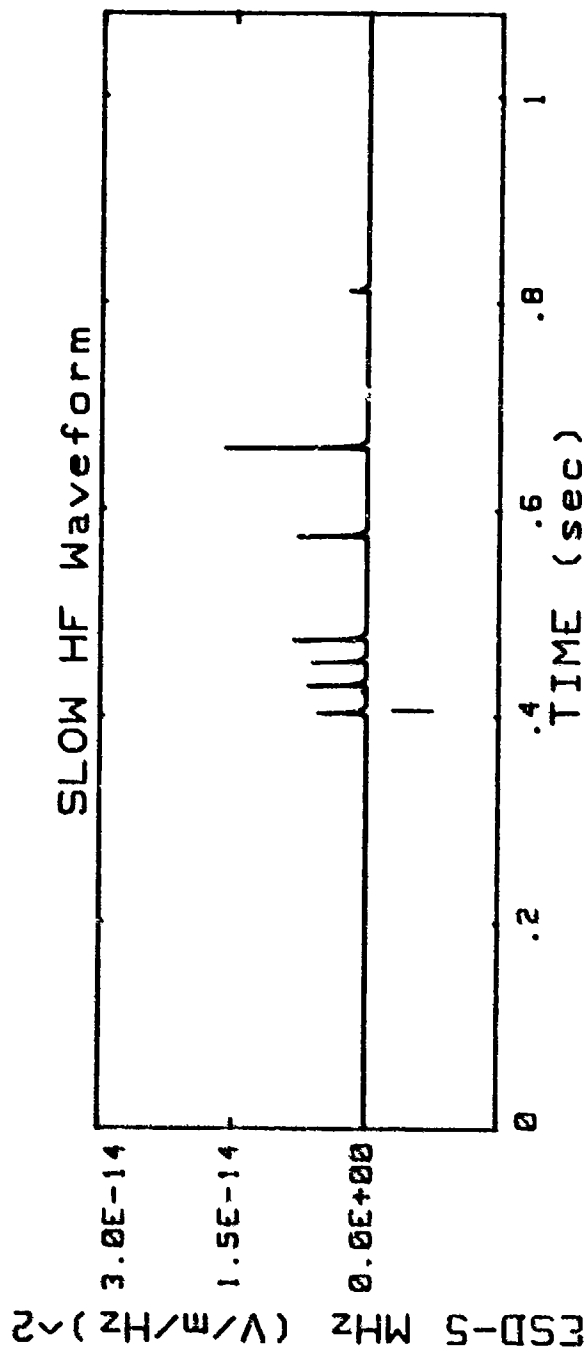
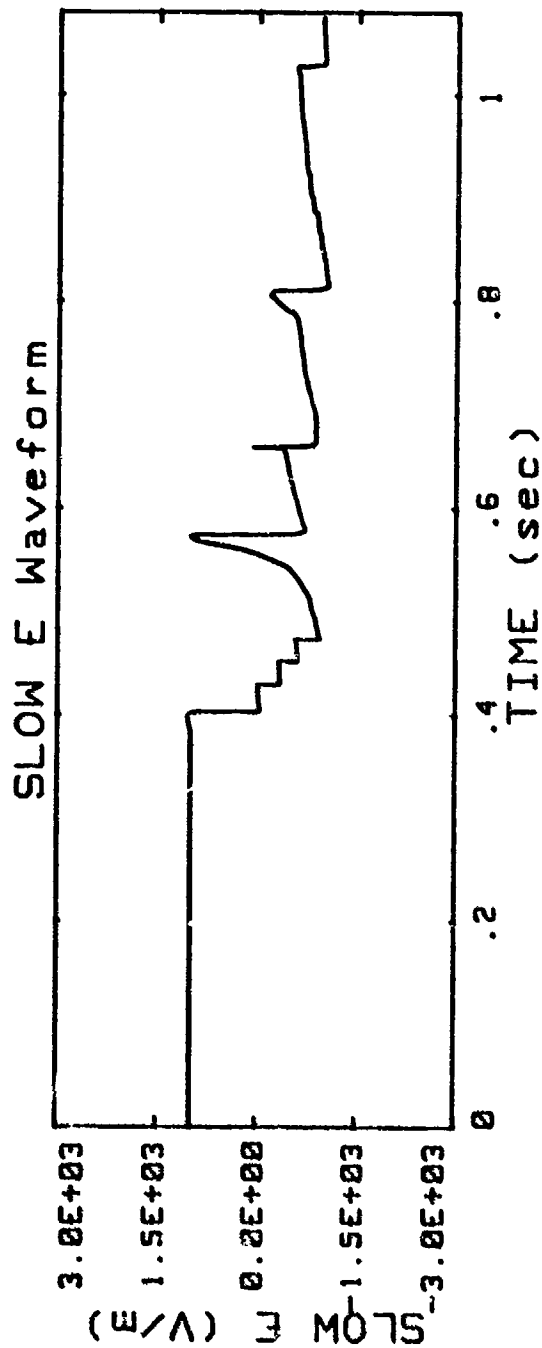


222170801.103 1985

1st RS (4.9 Km)

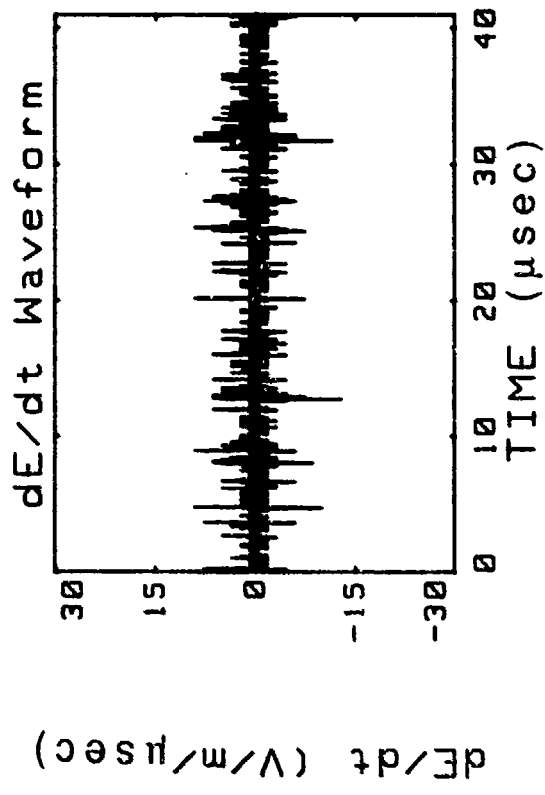
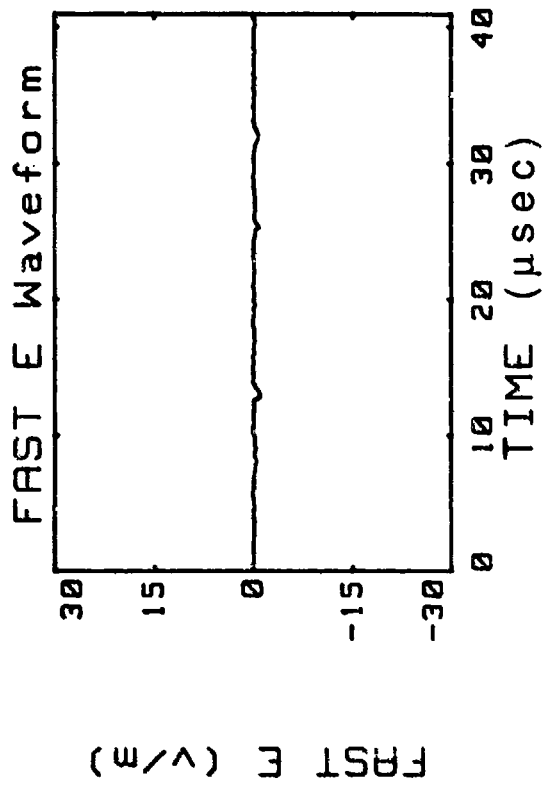
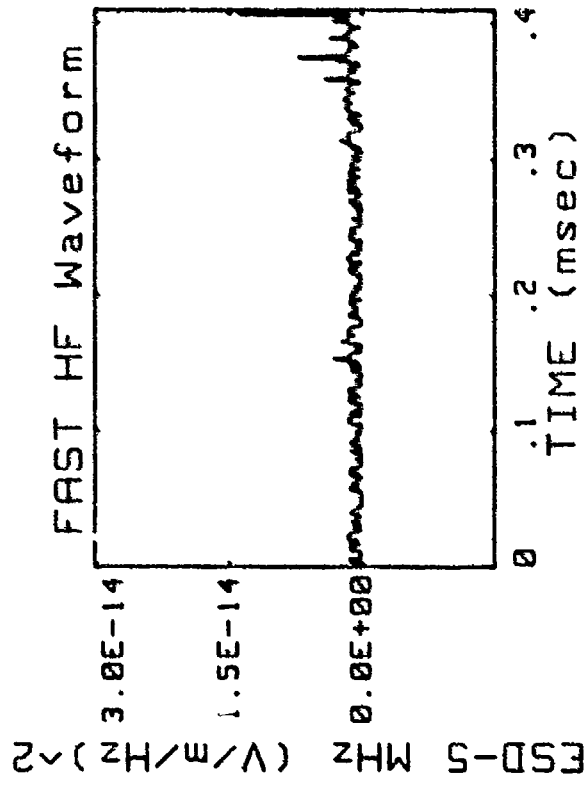
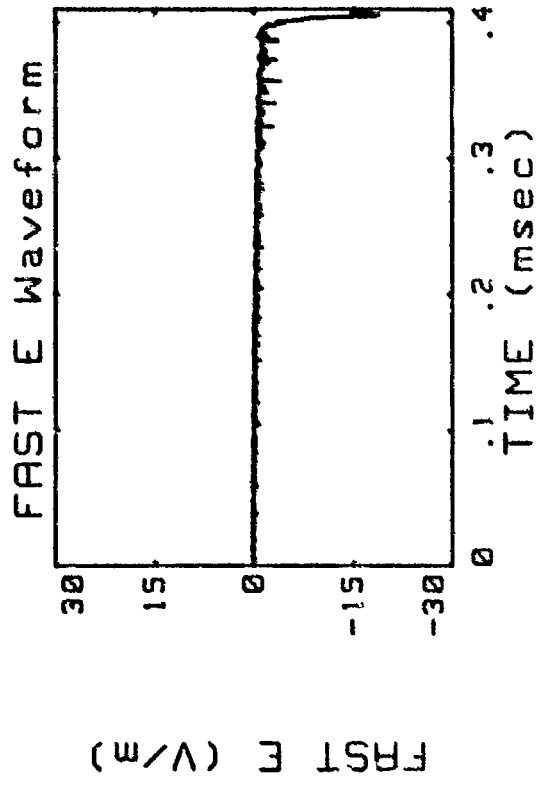


17:08:00.710 10 Aug 1985 (4.9 Km)

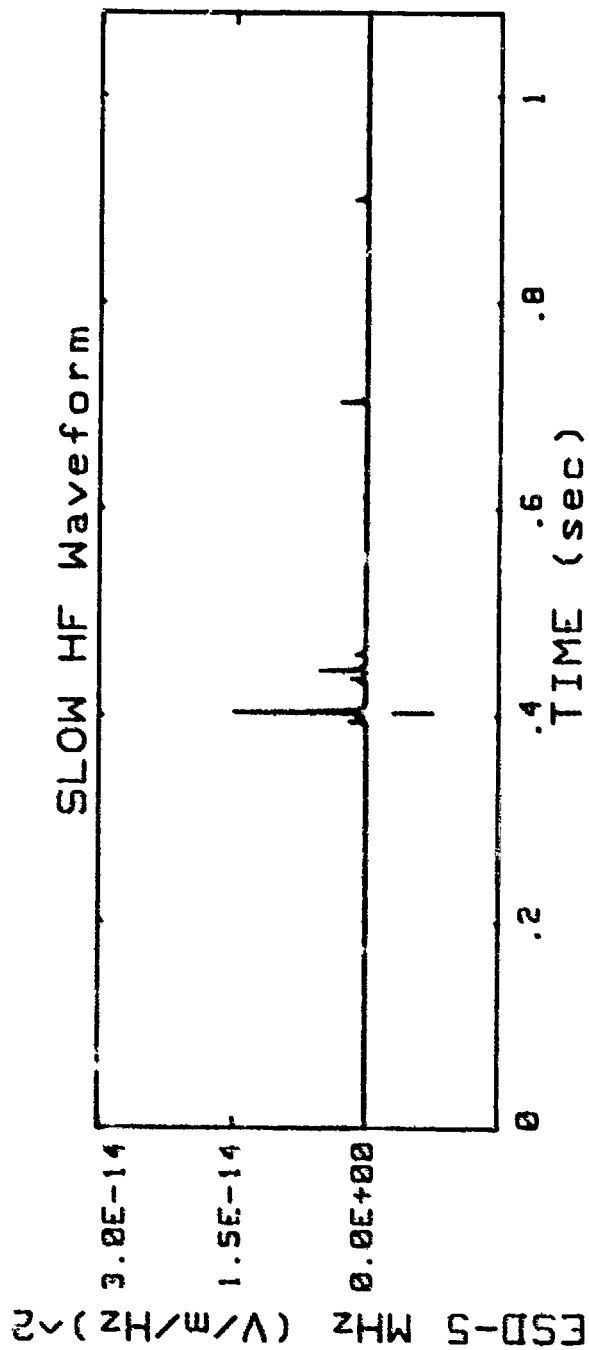
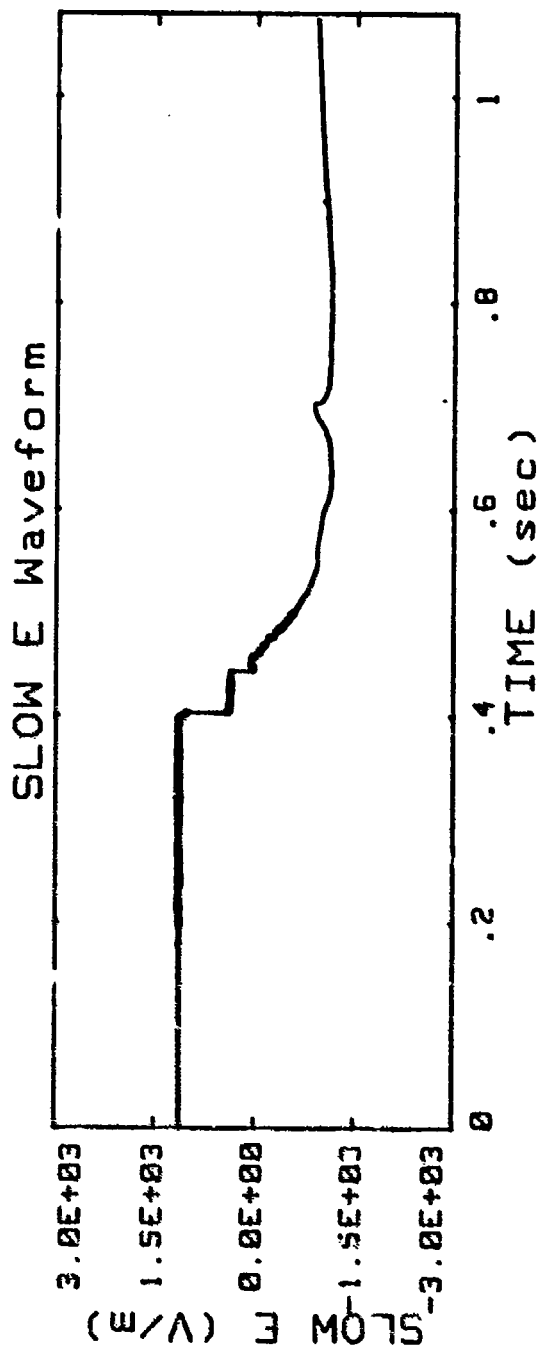


222171316.867 1985

Stepped Leader (8.1 Km)

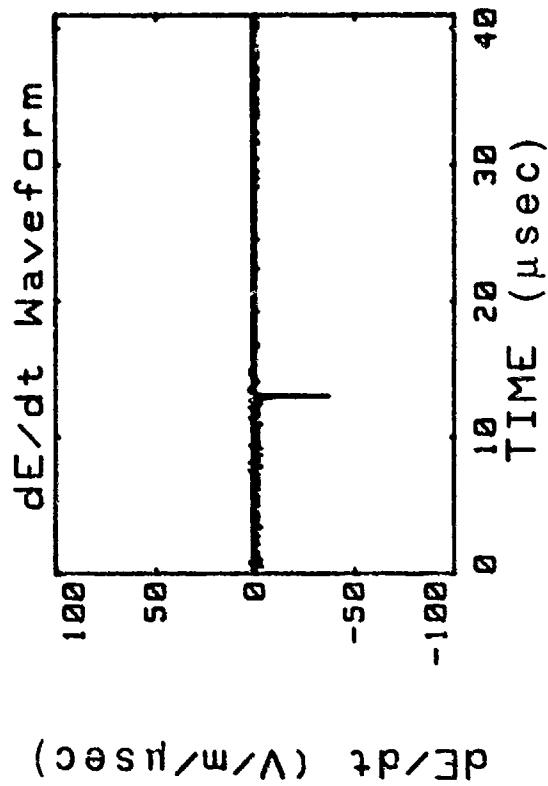
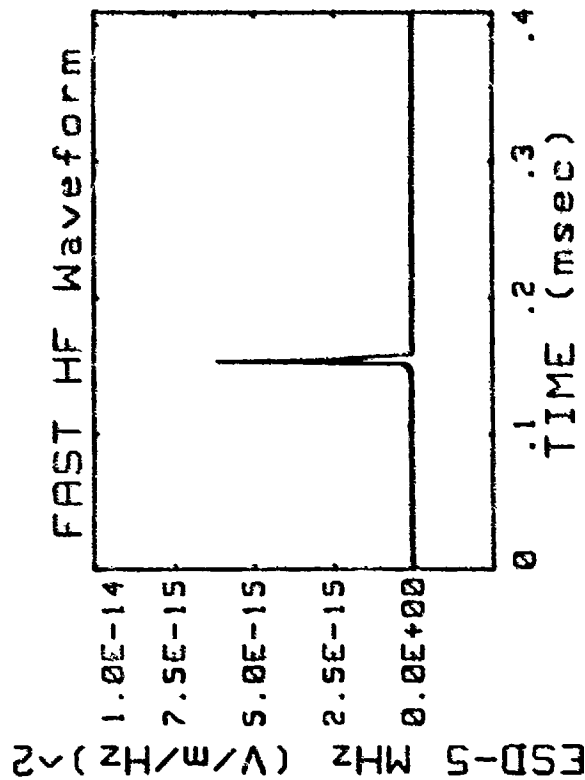
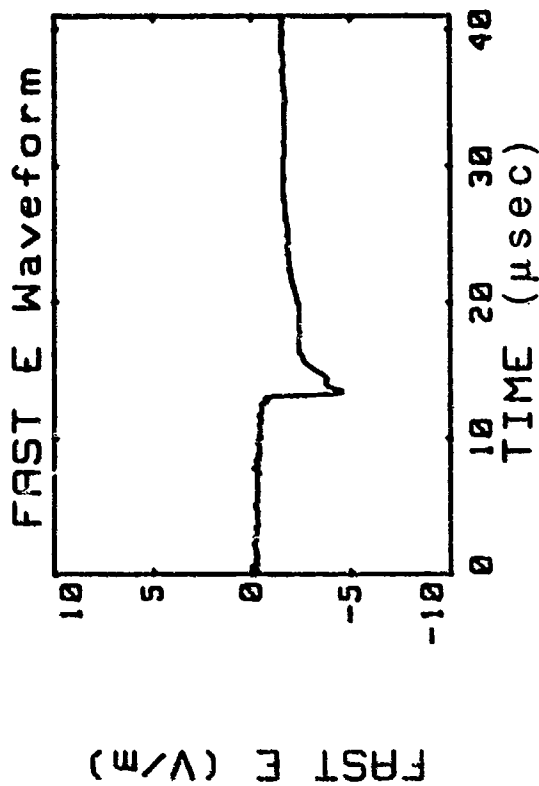
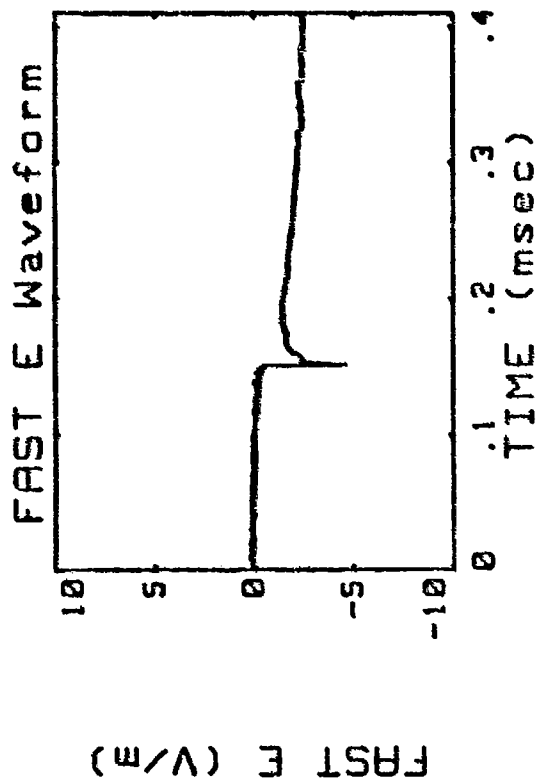


17:13:16.477 10 Aug 1985 (8.1 Km)



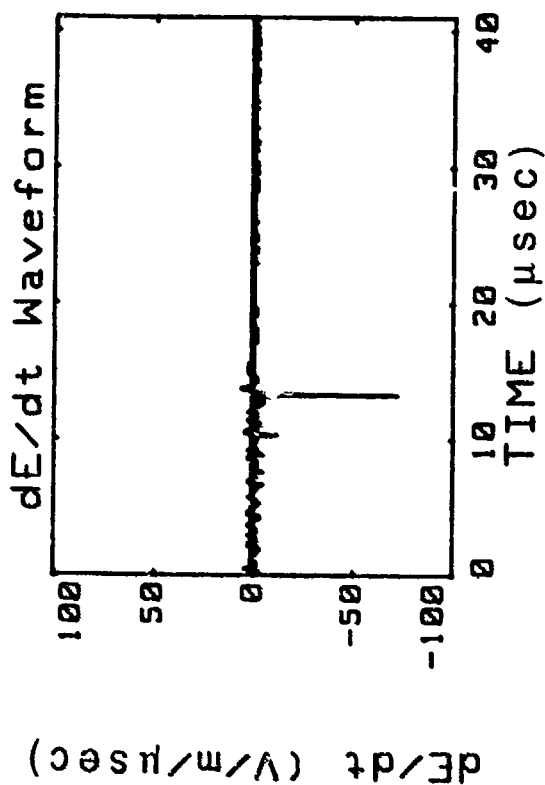
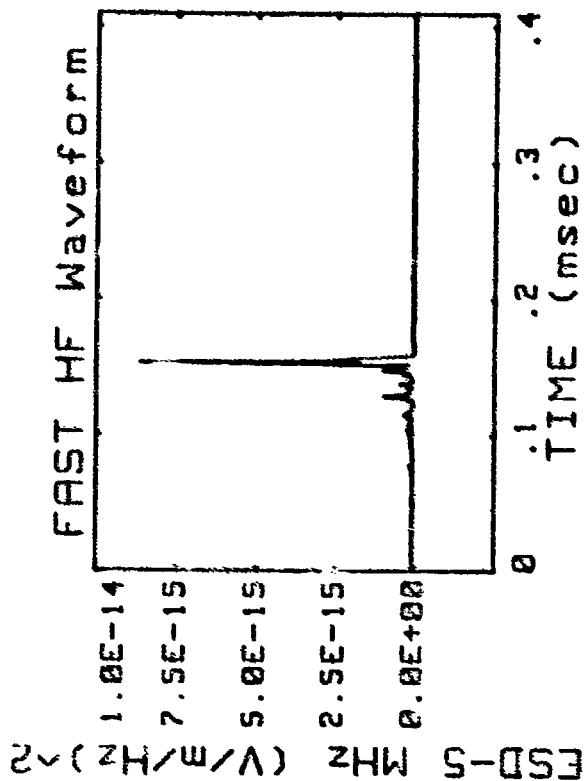
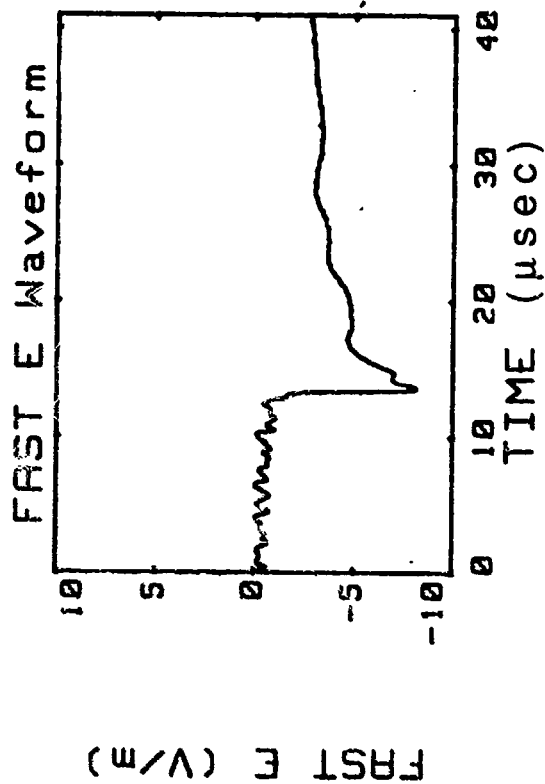
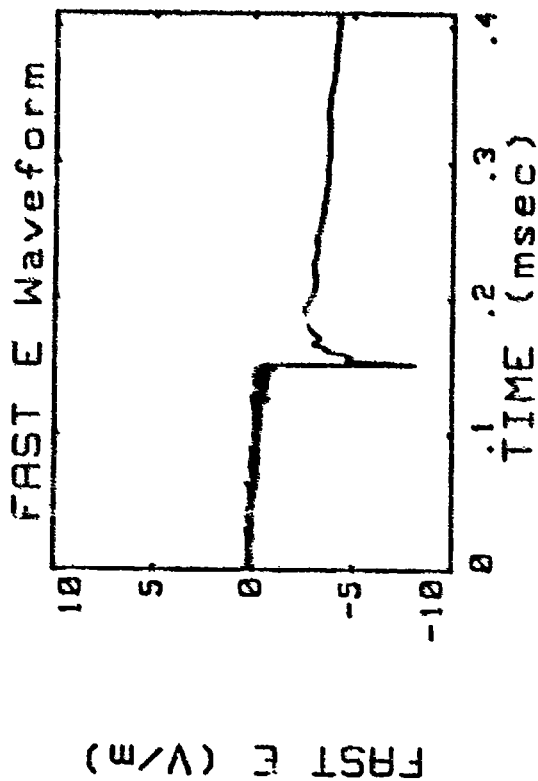
222171459.825 1985

Norm Subs RS (9.8 Km)



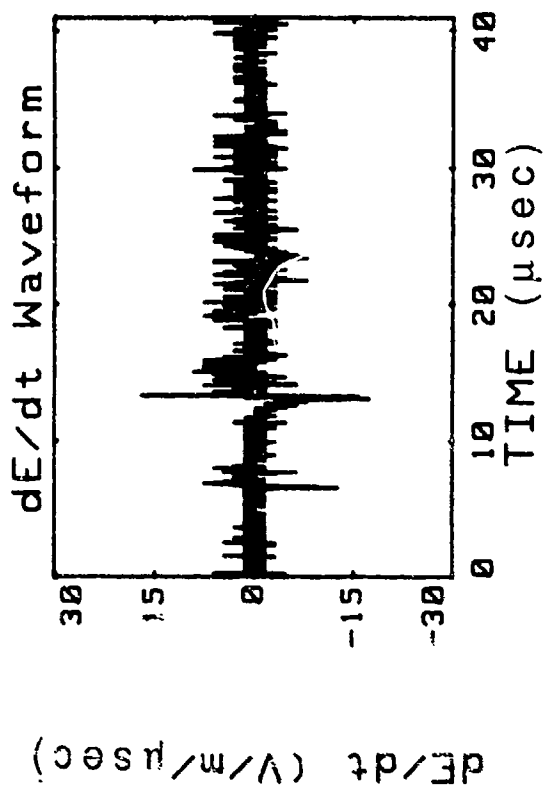
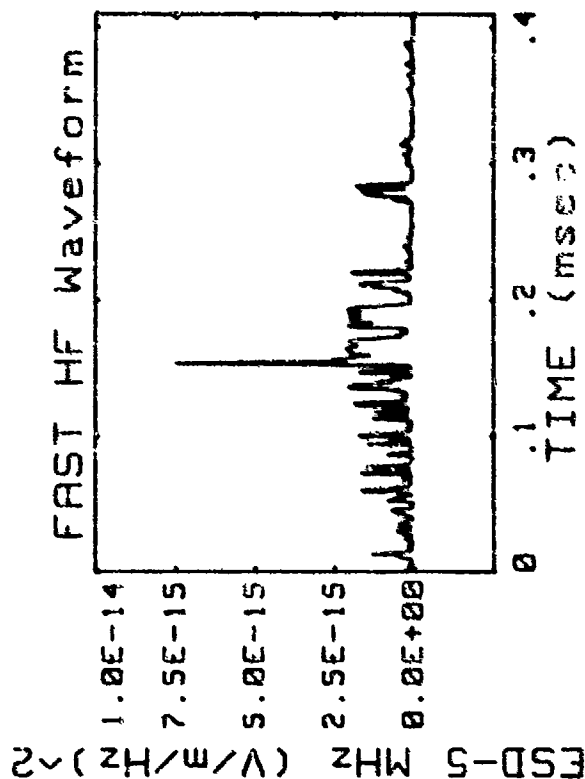
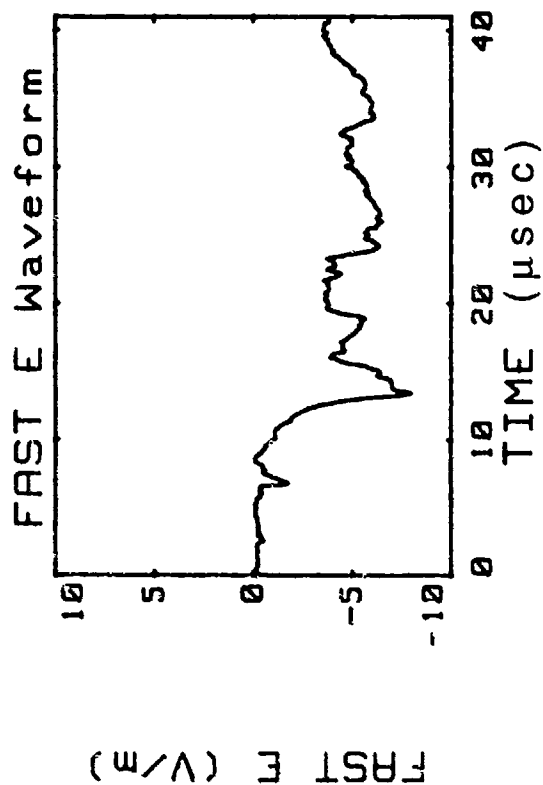
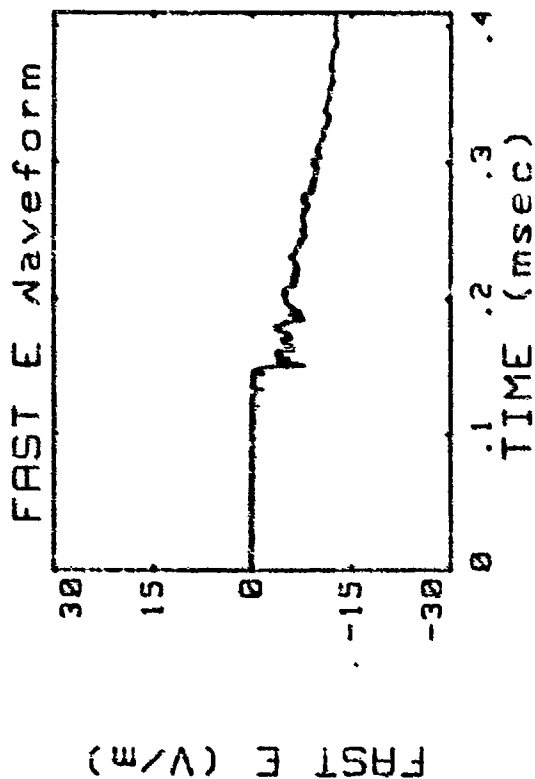
222171459.925 1985

Chaotic Subs RS (9.8 Km)

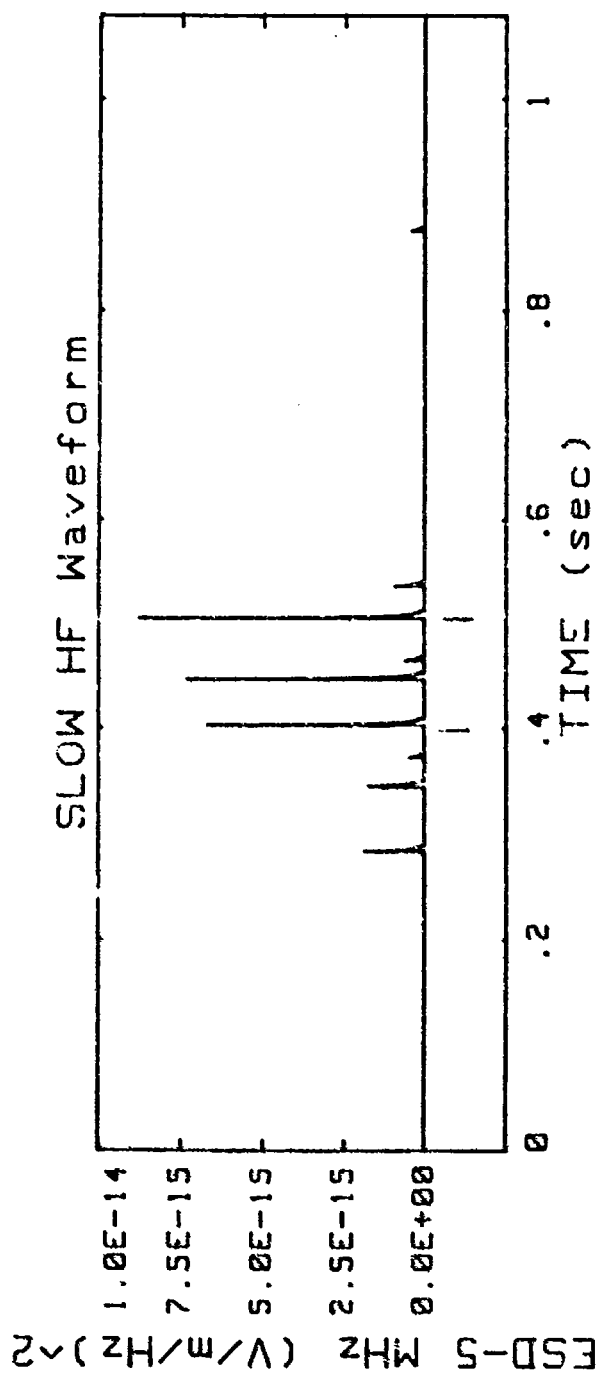
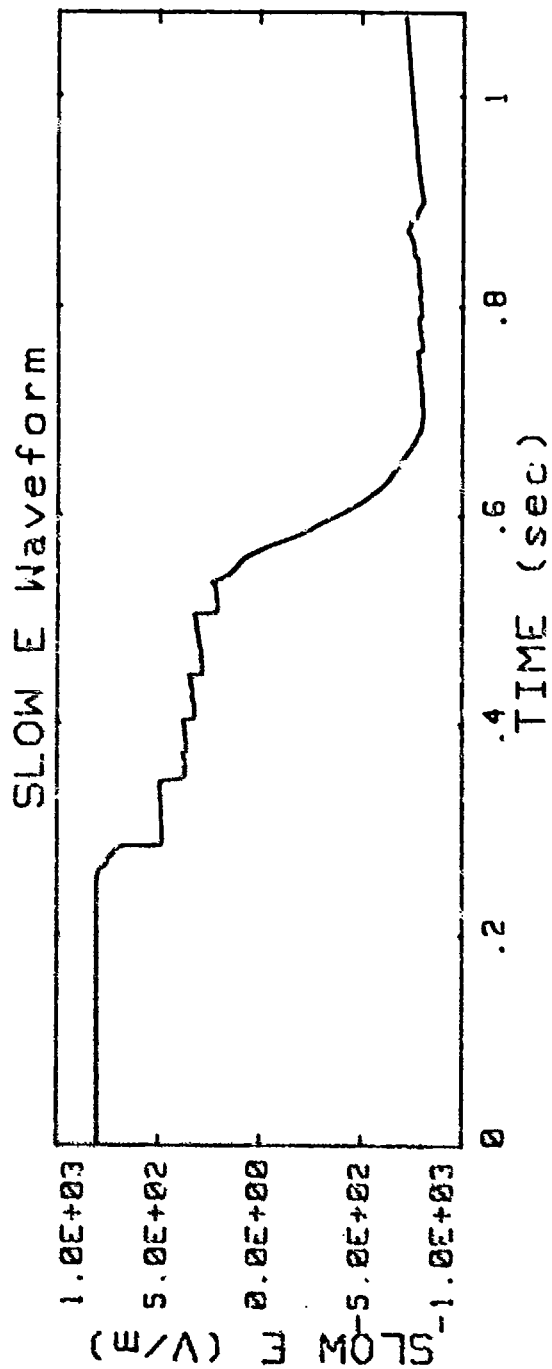


222171820.611 1985

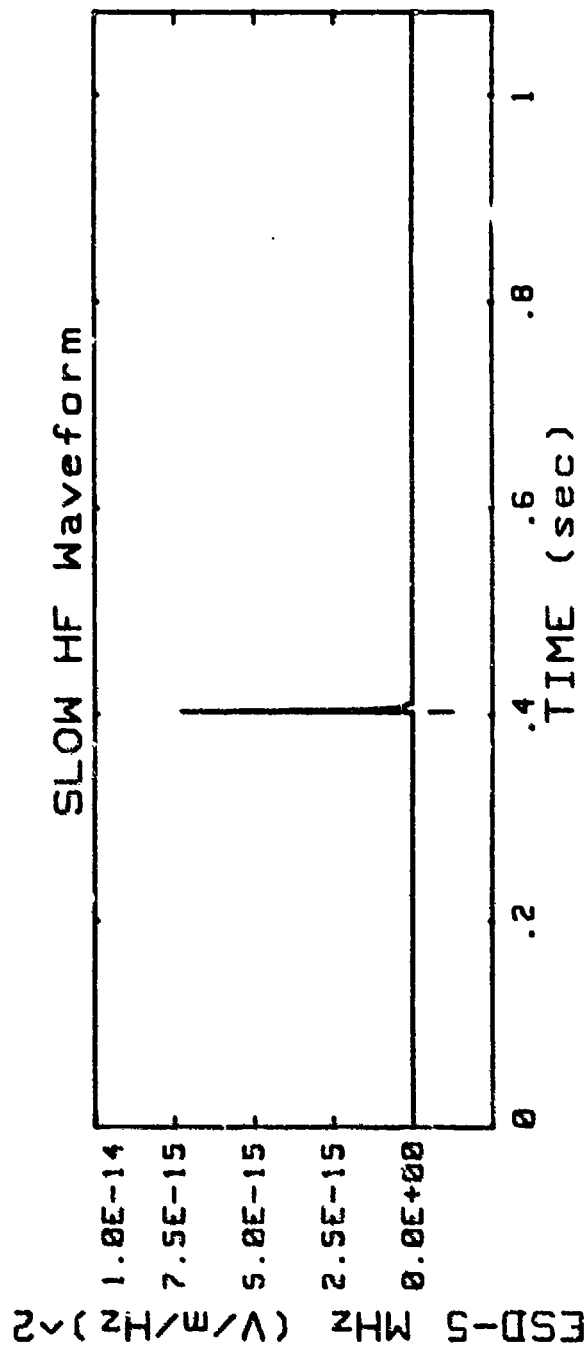
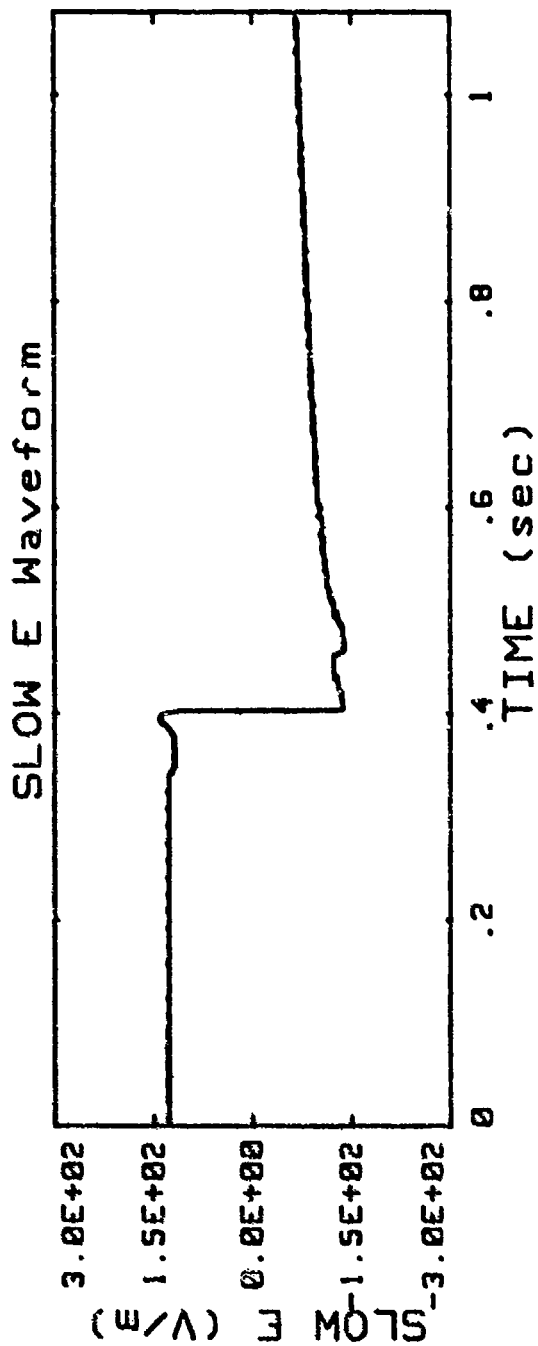
1st RS (9.2 Km)



17:14:59.430 10 Aug 1985 (9.8 Km)

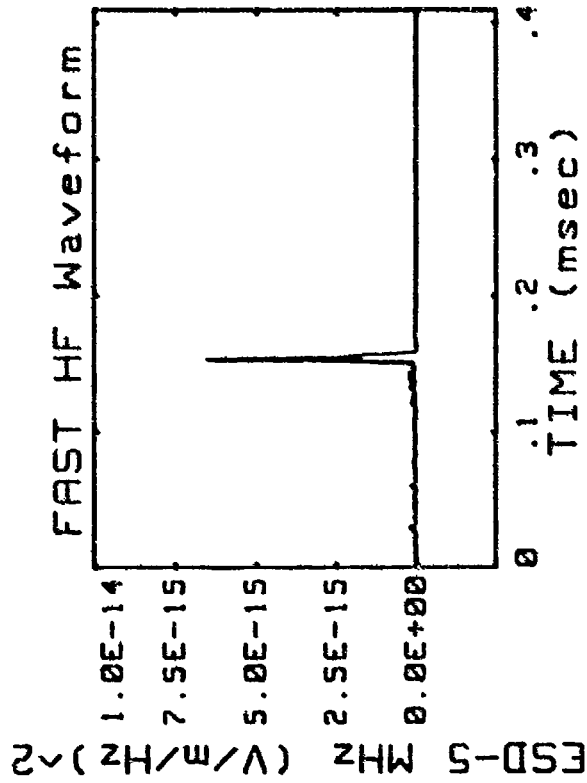
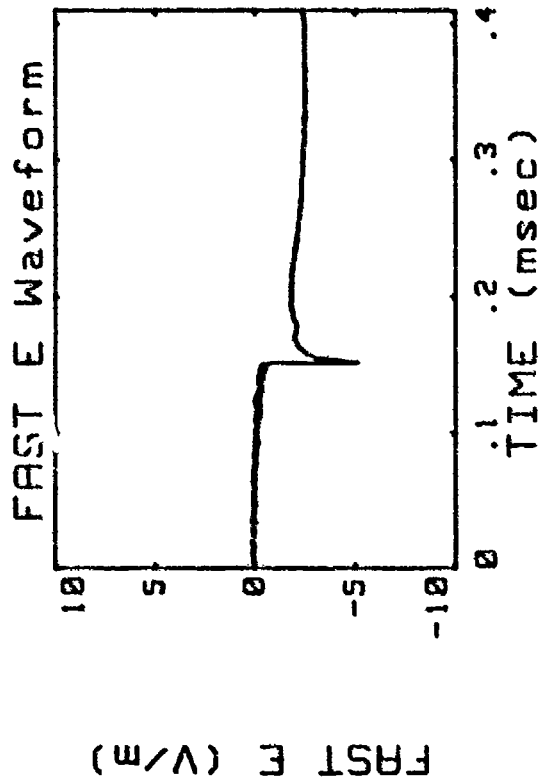


17:18:20.221 10 Aug 1985 (9.2 Km)



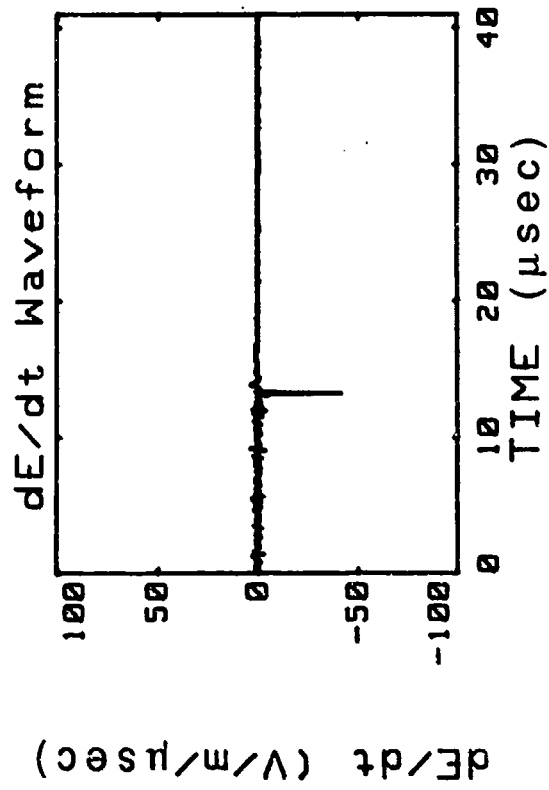
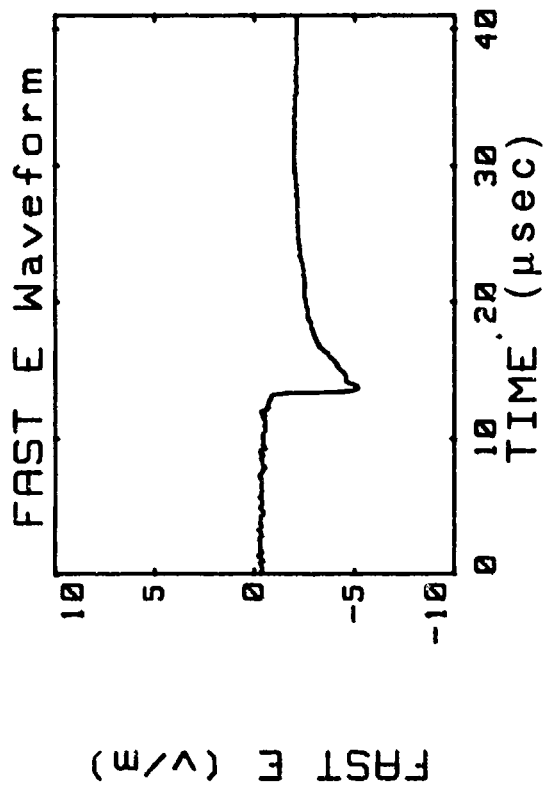
r •

222171901.488 1985



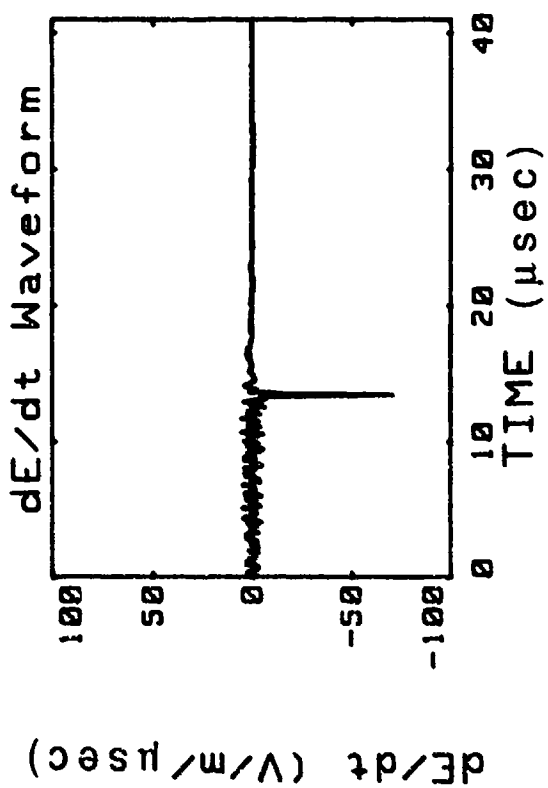
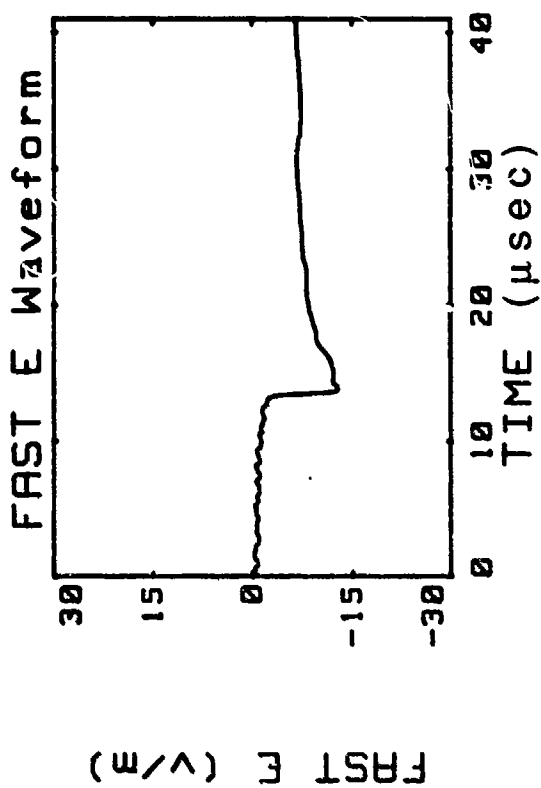
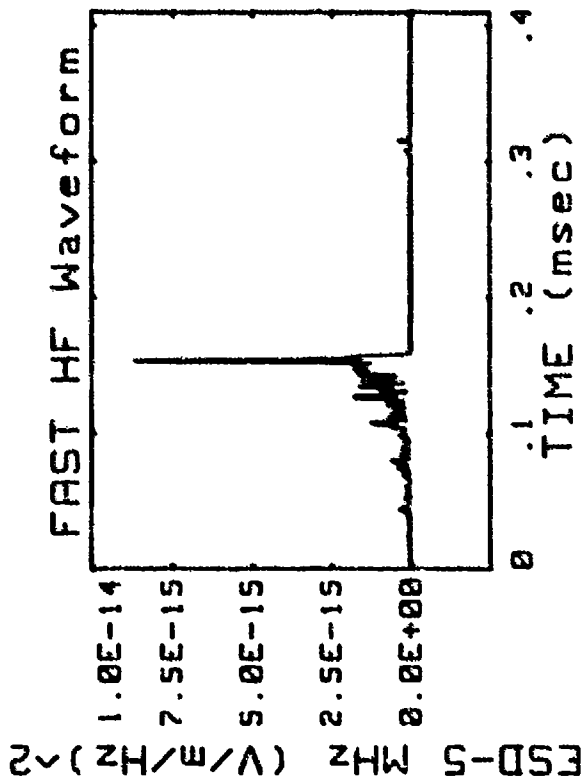
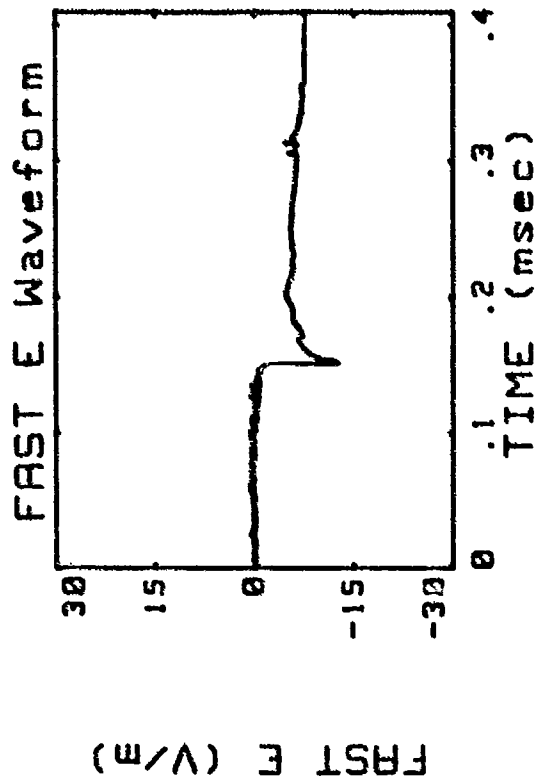
r •

Norm Subs RS (9.1 Km)

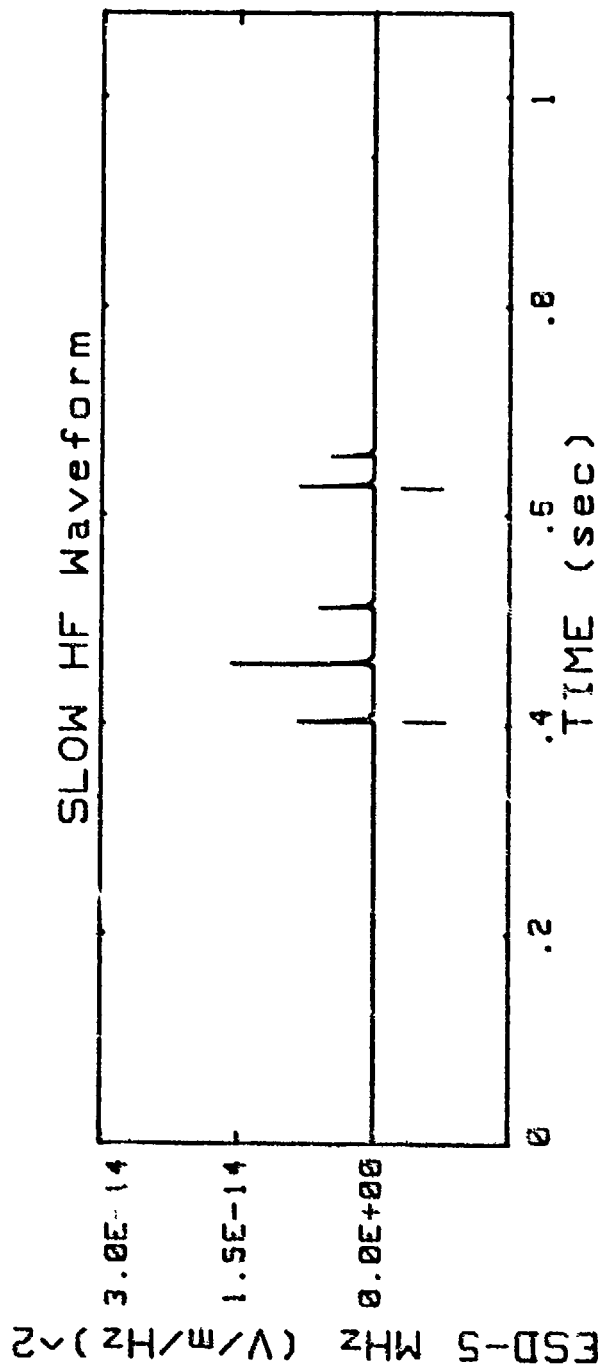
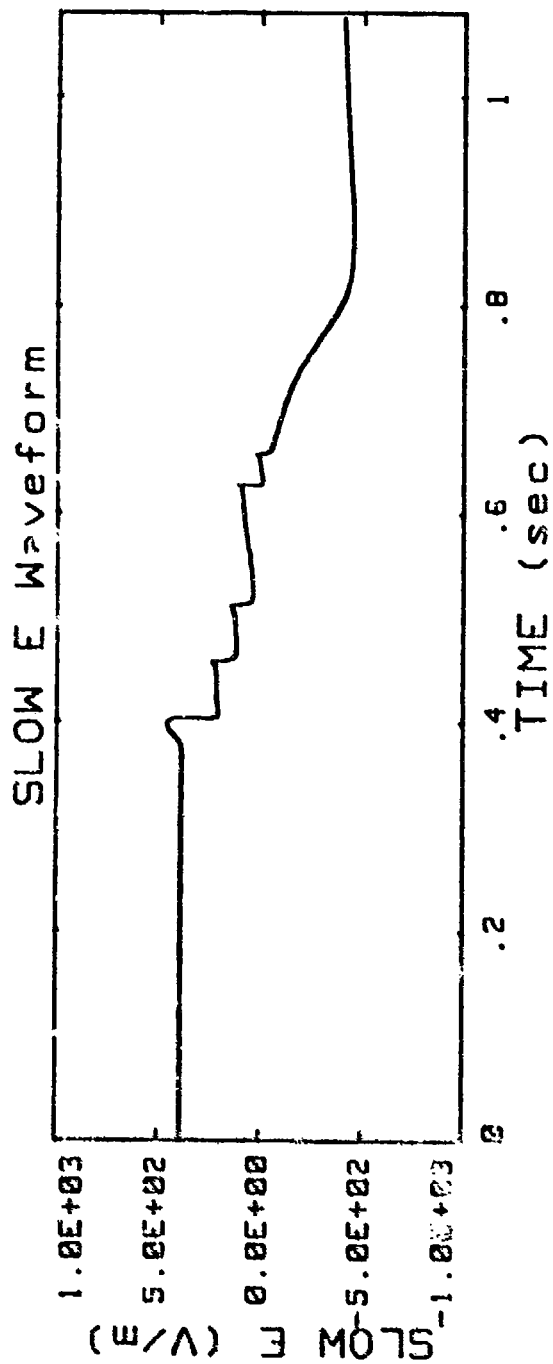


222171901.606 1985

Chaotic Subs RS (9.1 Km)

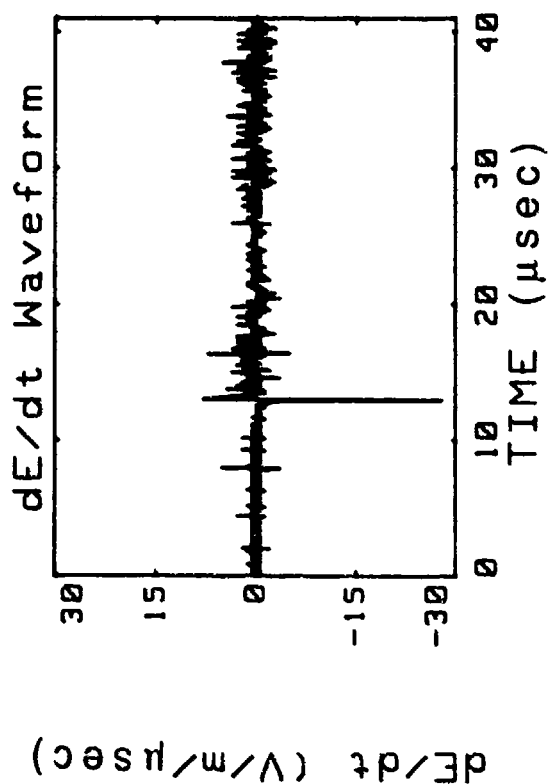
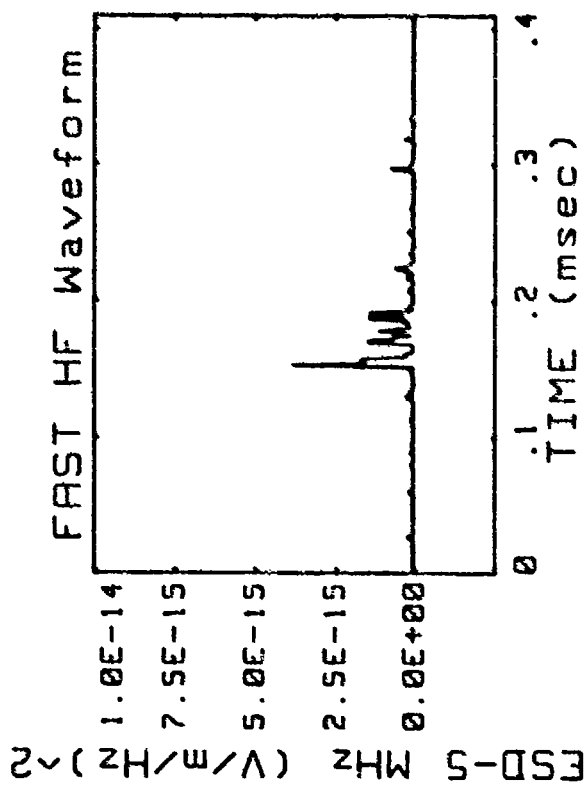
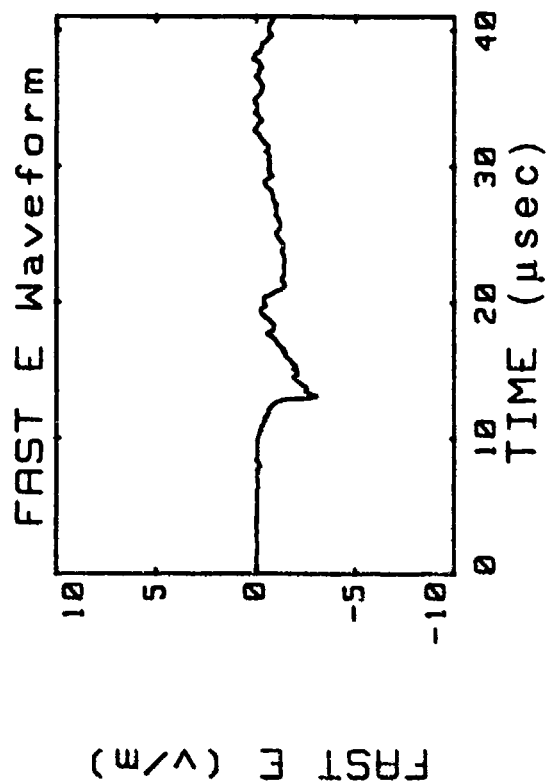
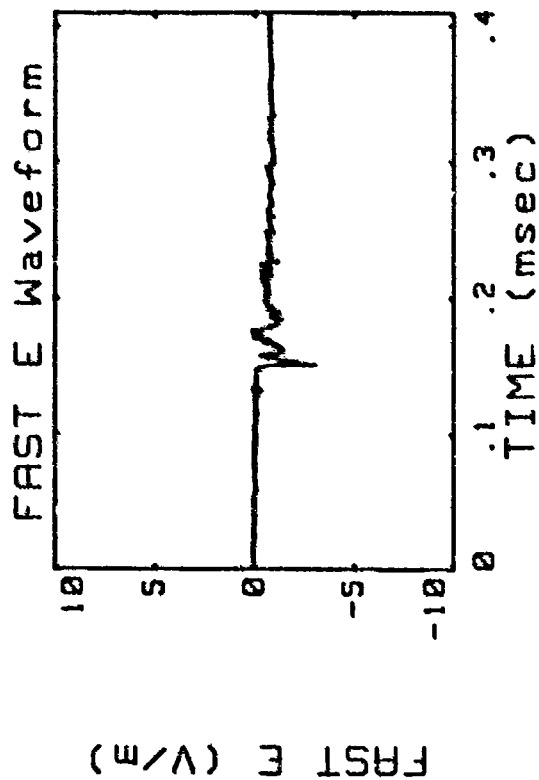


17:19:00.993 10 Aug 1985 (9.1 Km)

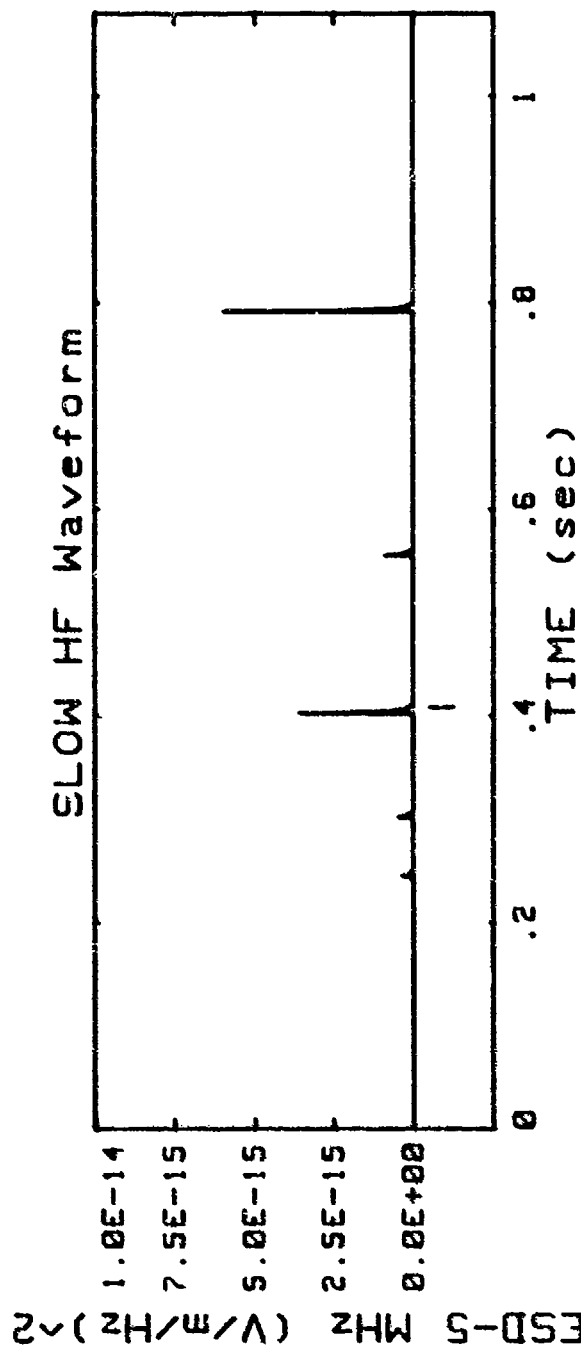
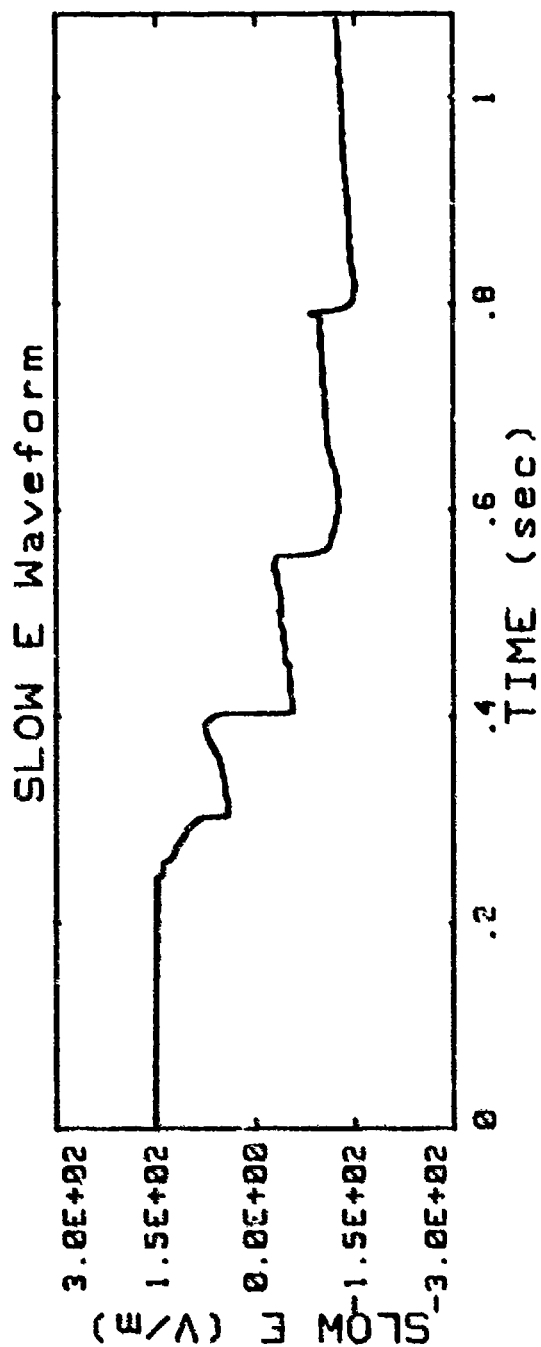


222172050.337 1985

1st RS (8.4 Km)

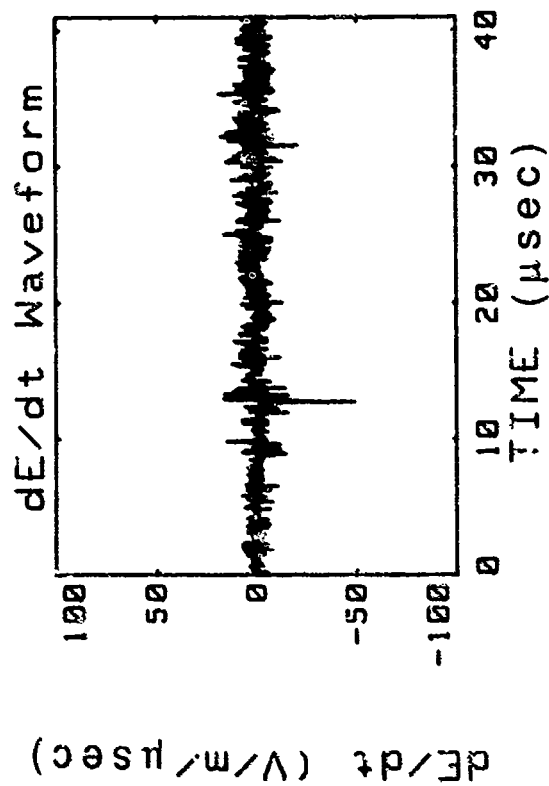
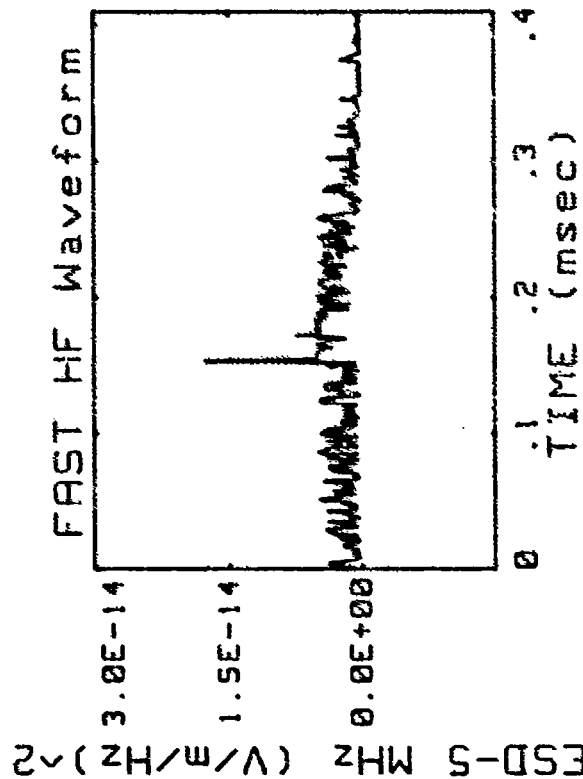
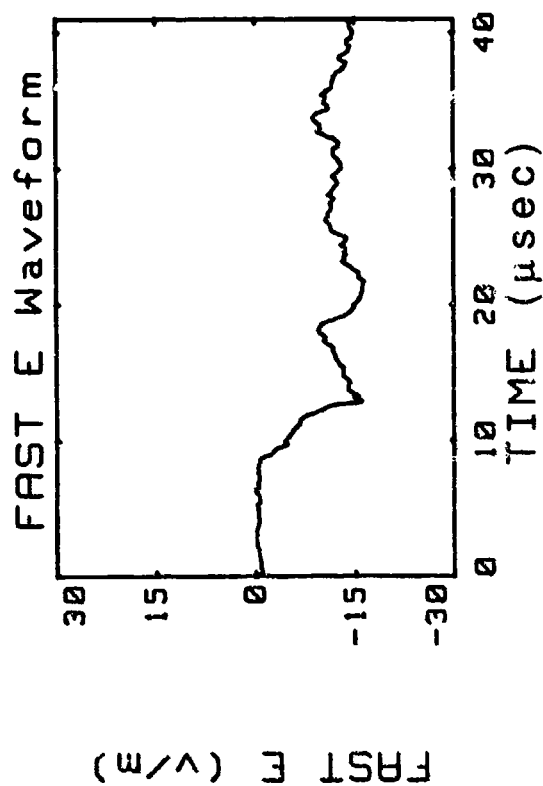
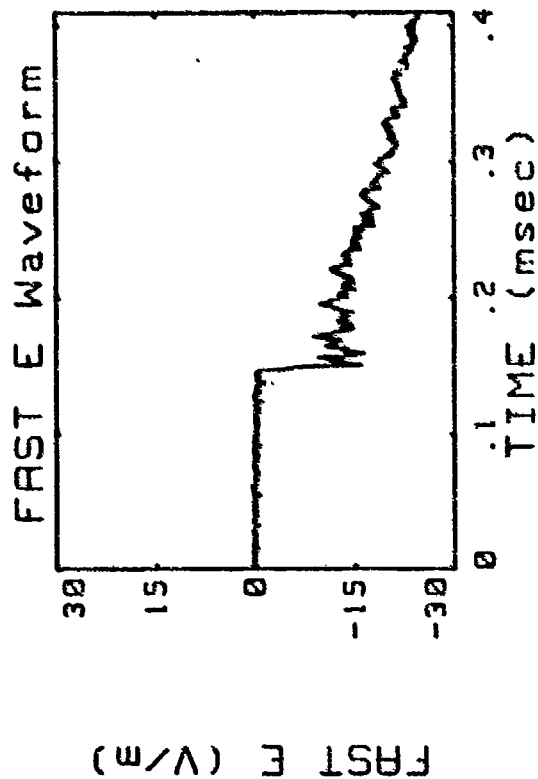


17:20:49.941 10 Aug 1985 (8.4 Km)

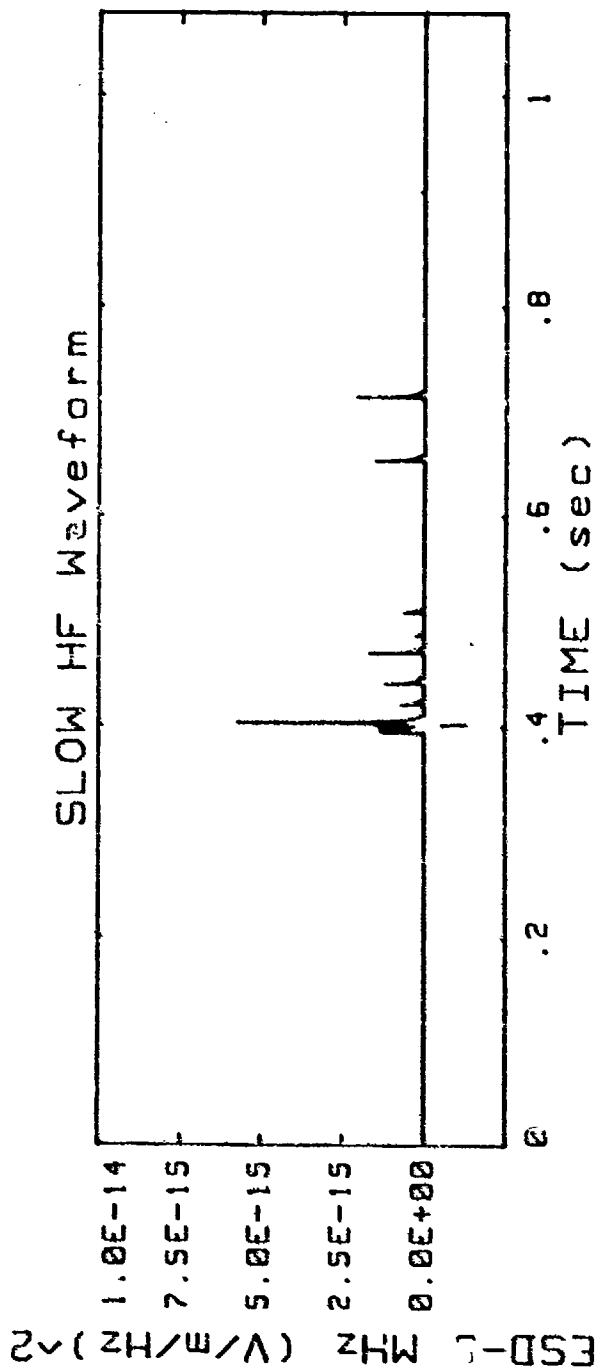
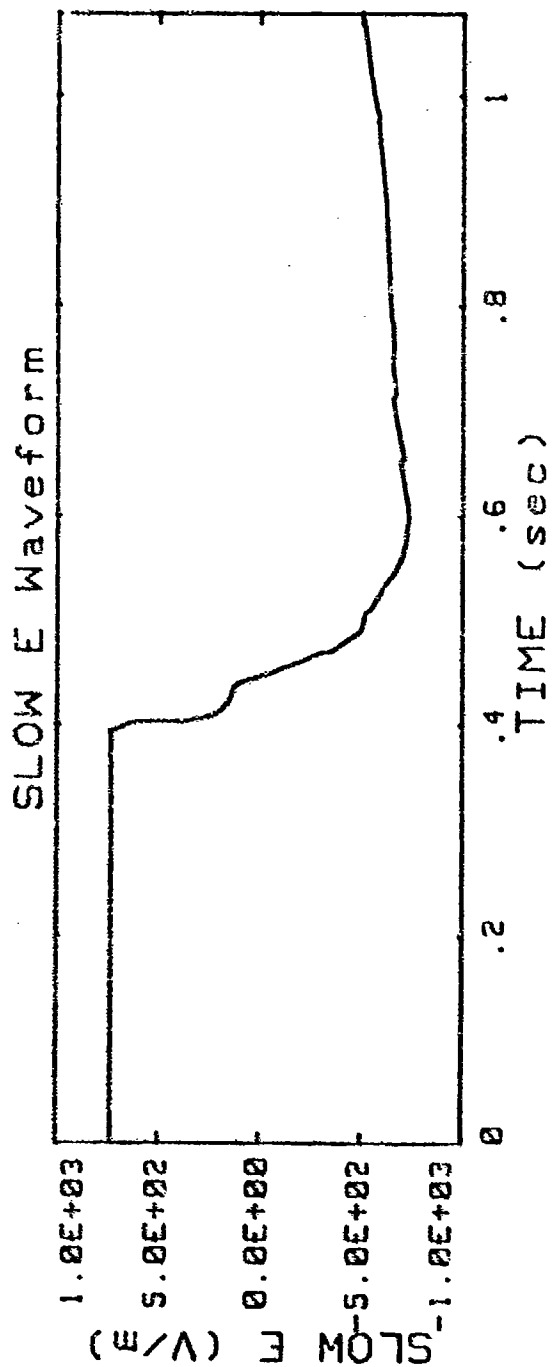


222172533.710 1985

1st RS (14.2 Km)

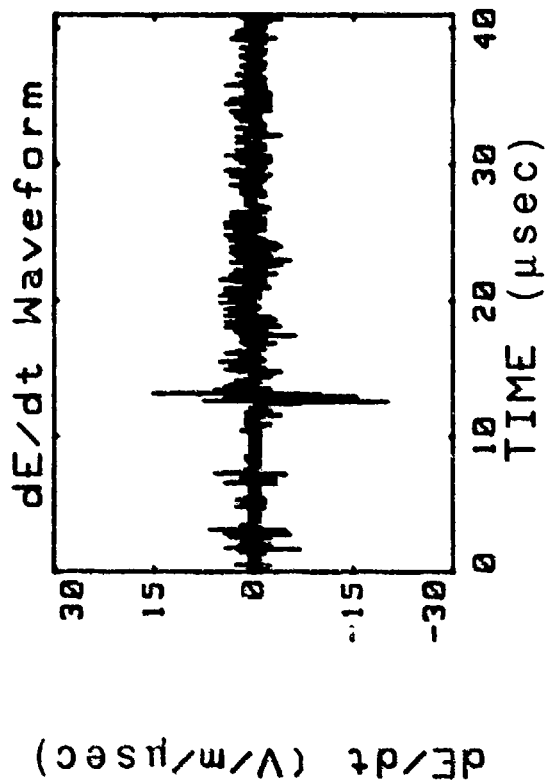
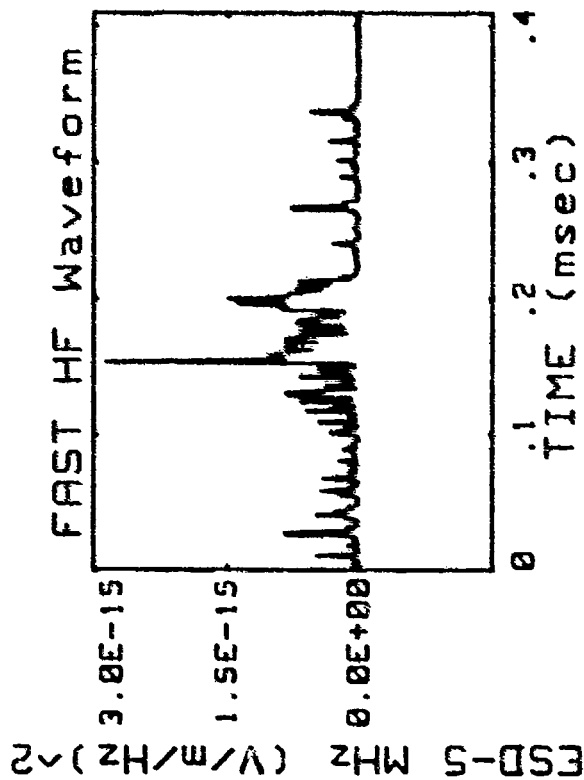
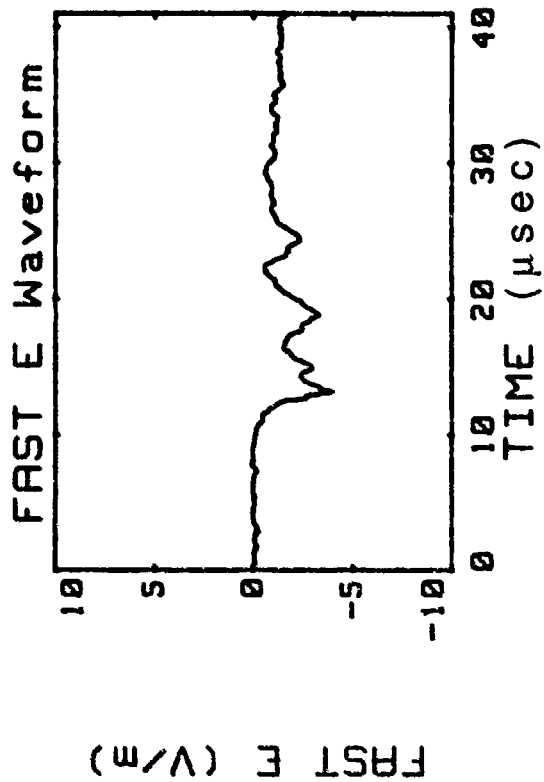
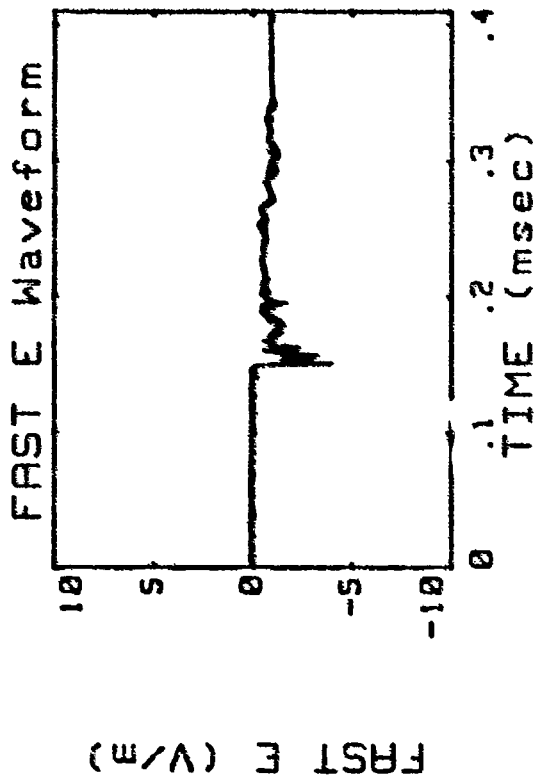


17:25:33.318 10 Aug 1985 (14.2 Km)

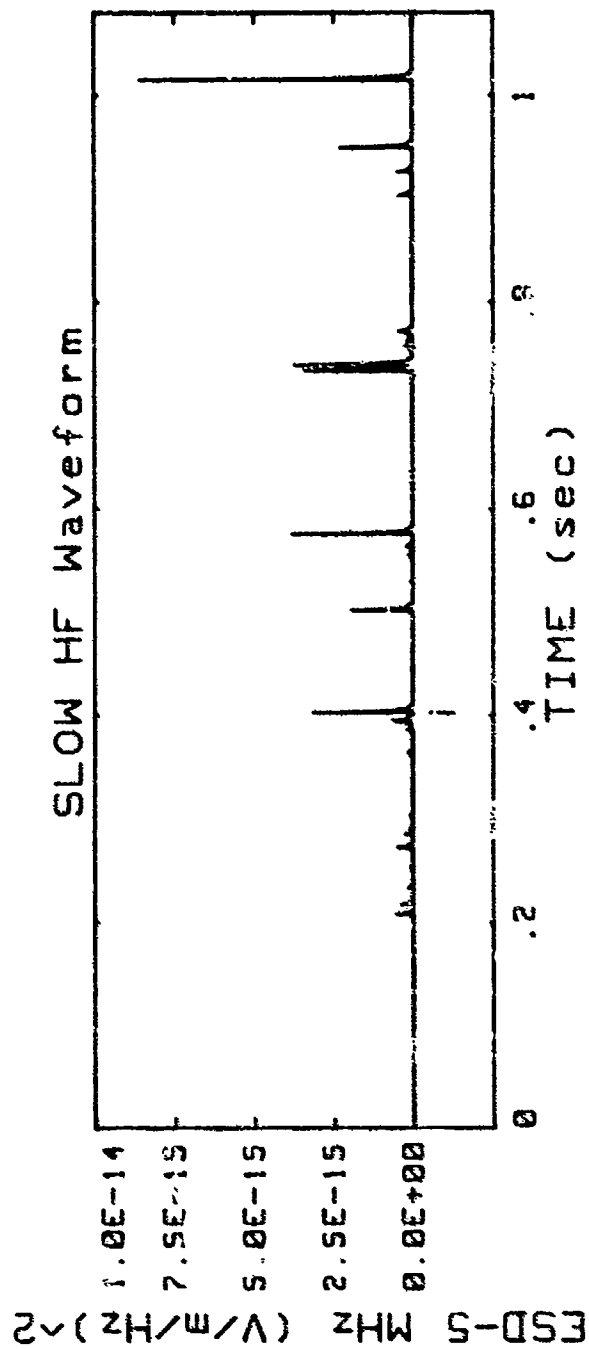
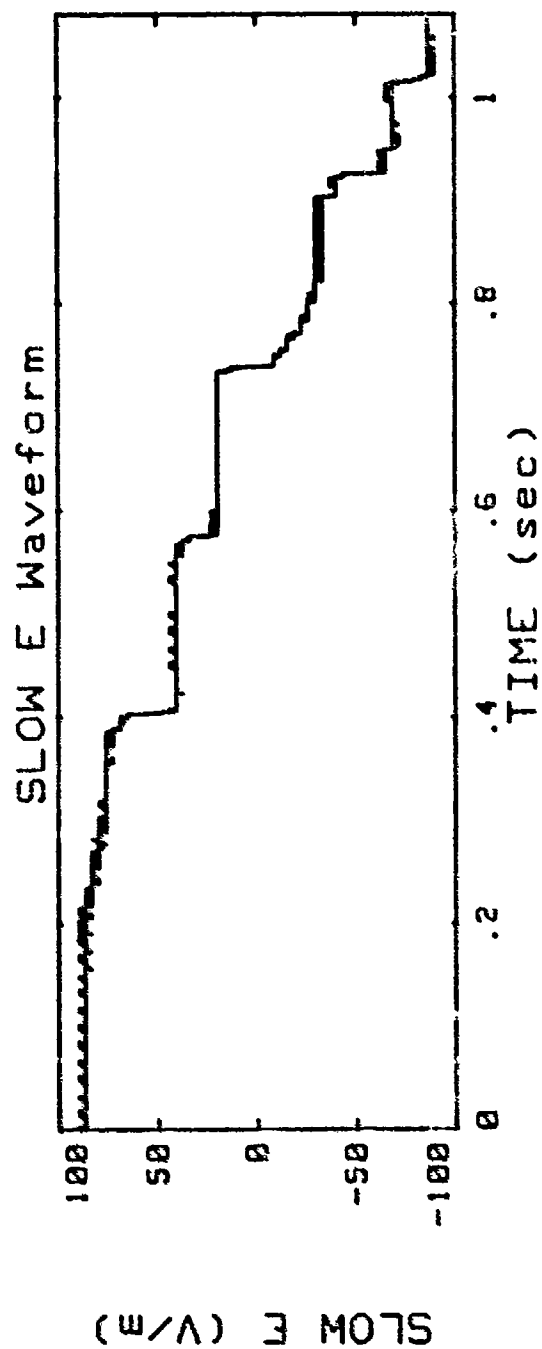


222173038.353 1985

1st RS (18.6 Km)

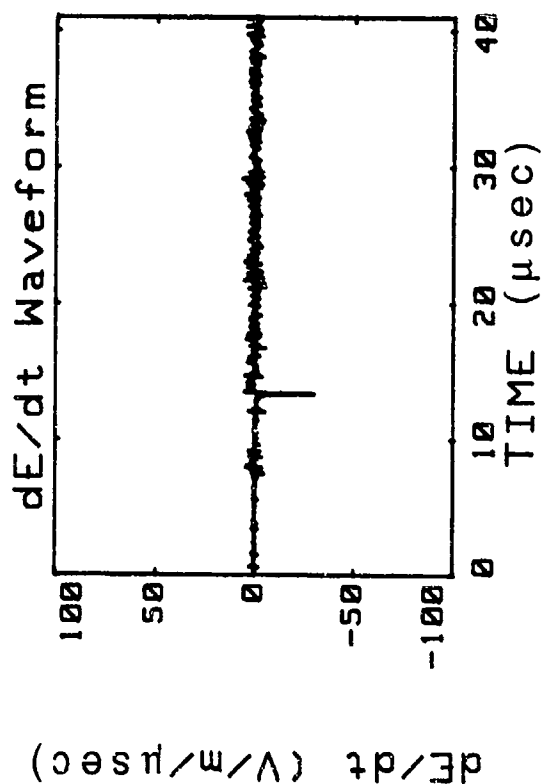
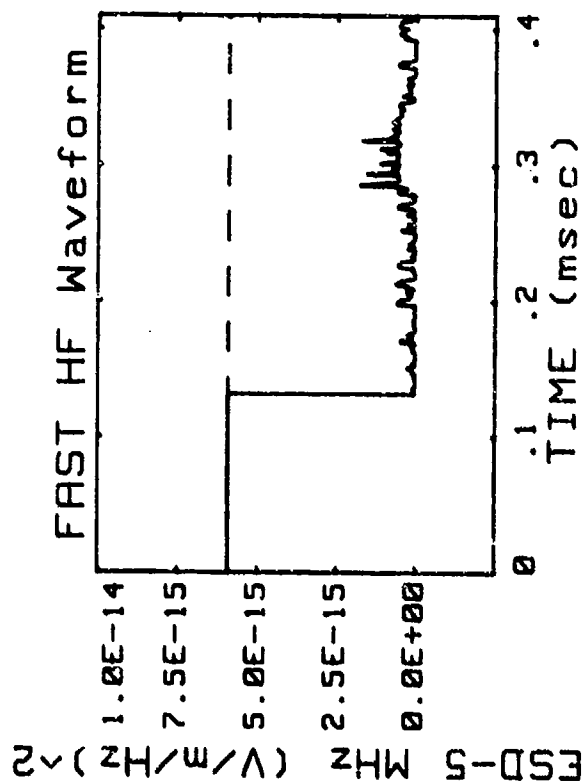
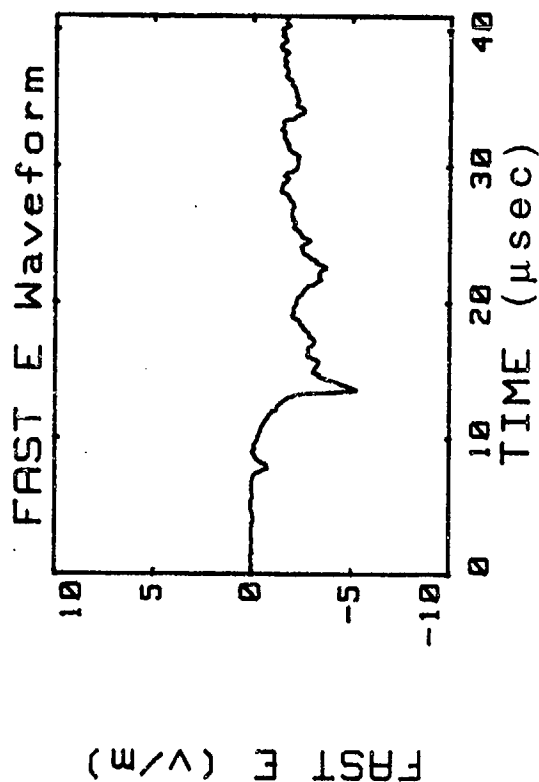
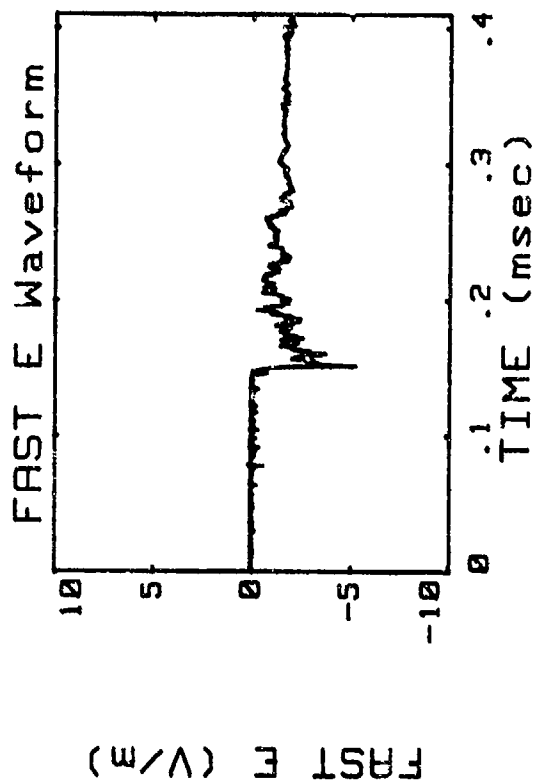


17:30:37.963 10 Aug 1985 (18.6 Km)

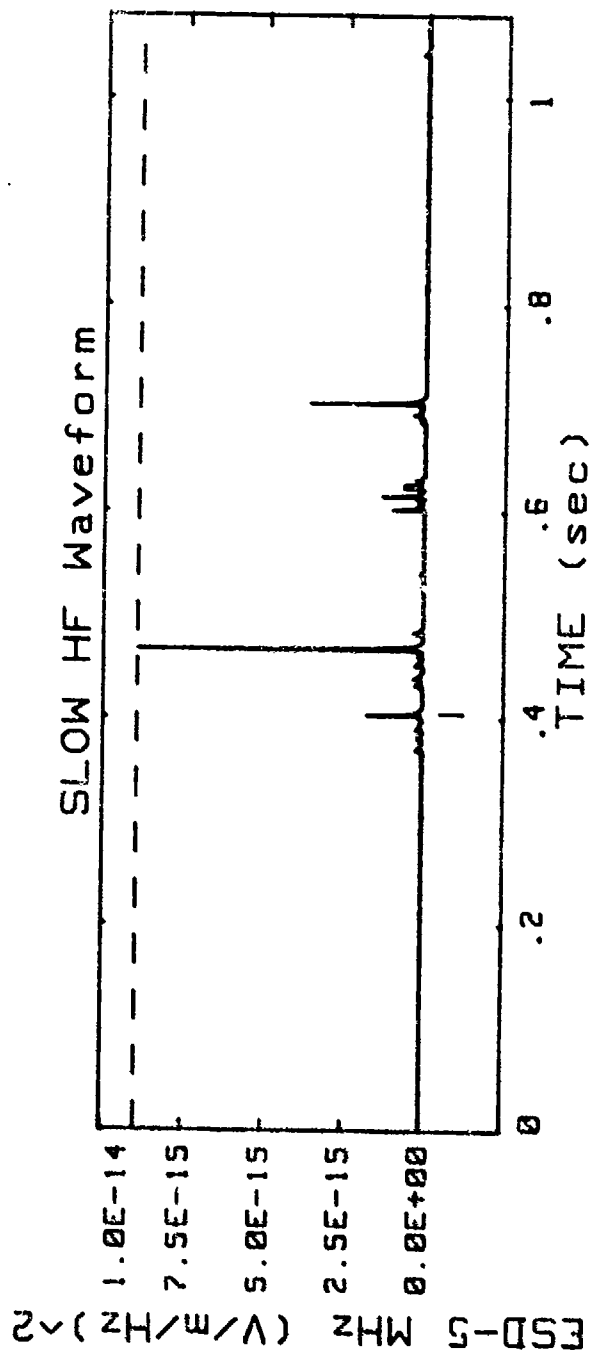
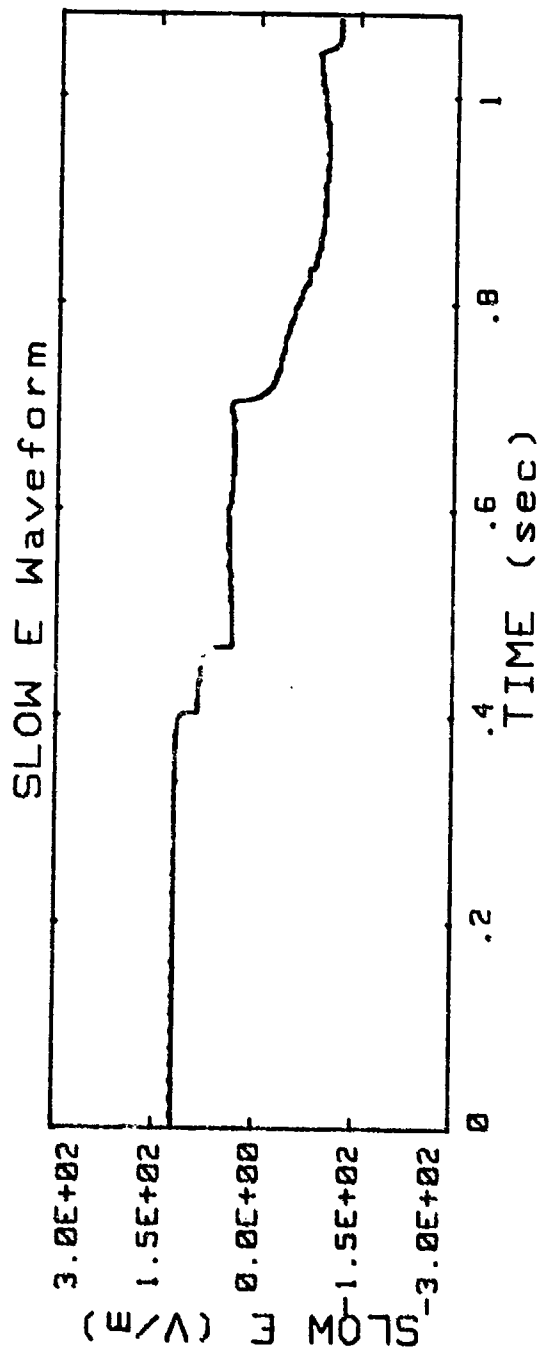


222173116.828 1985

1st RS (15.2 Km)

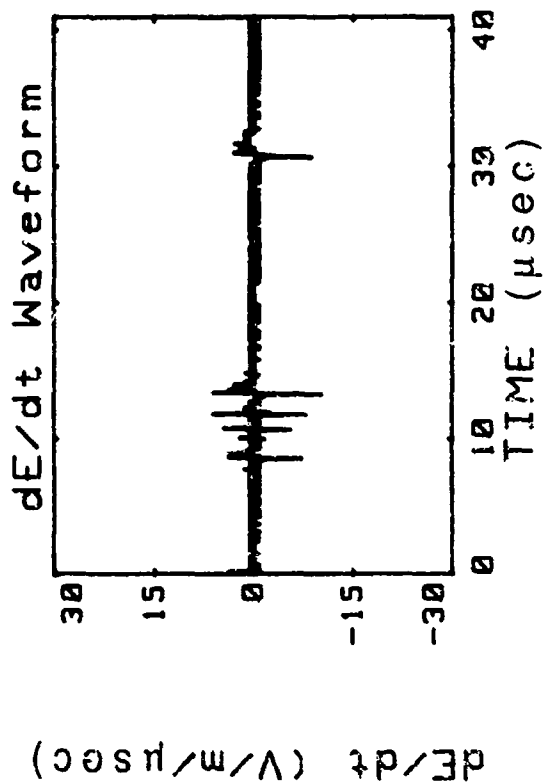
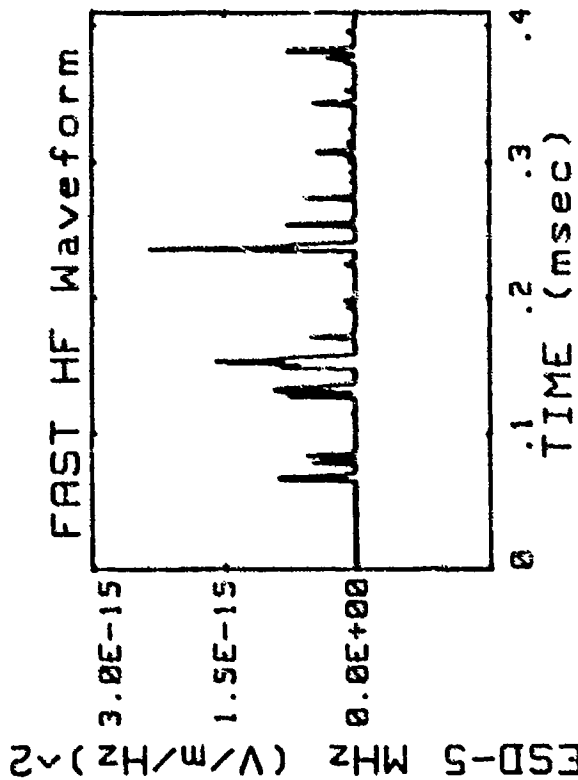
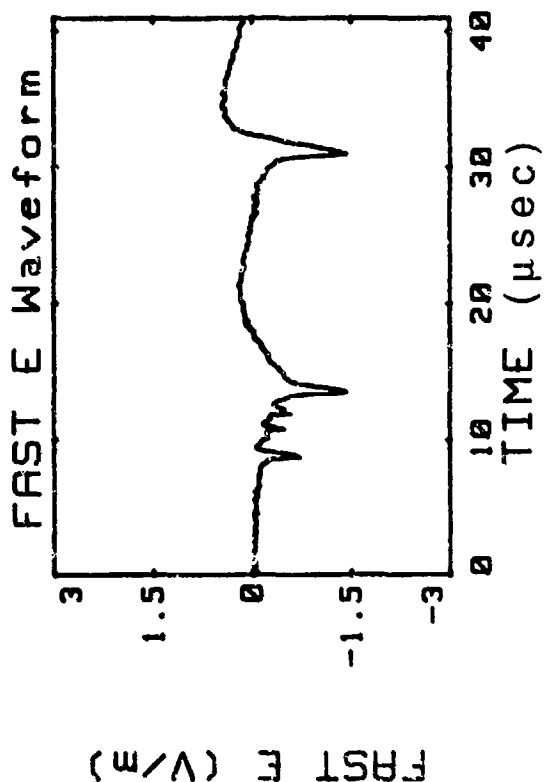
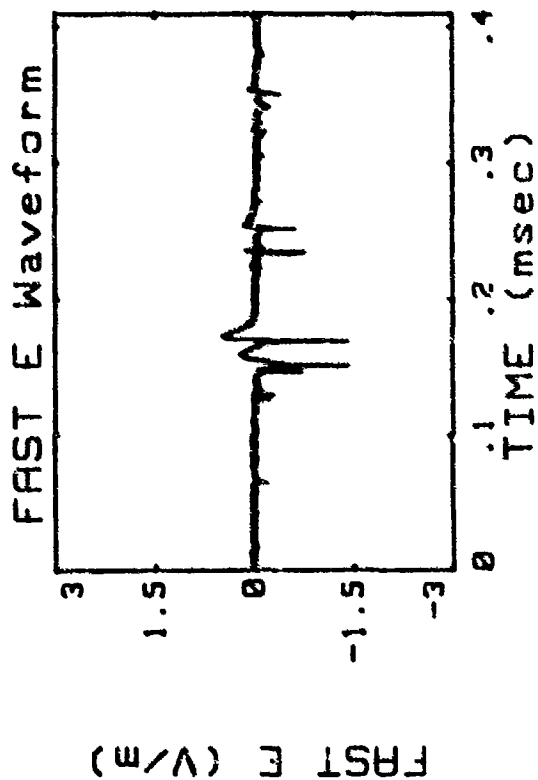


17:31:16.436 10 Aug 1985 (15.2 Km)



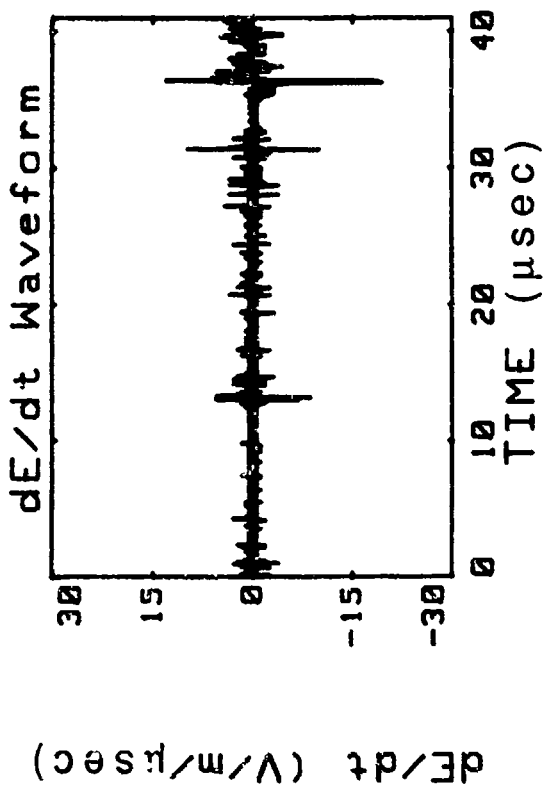
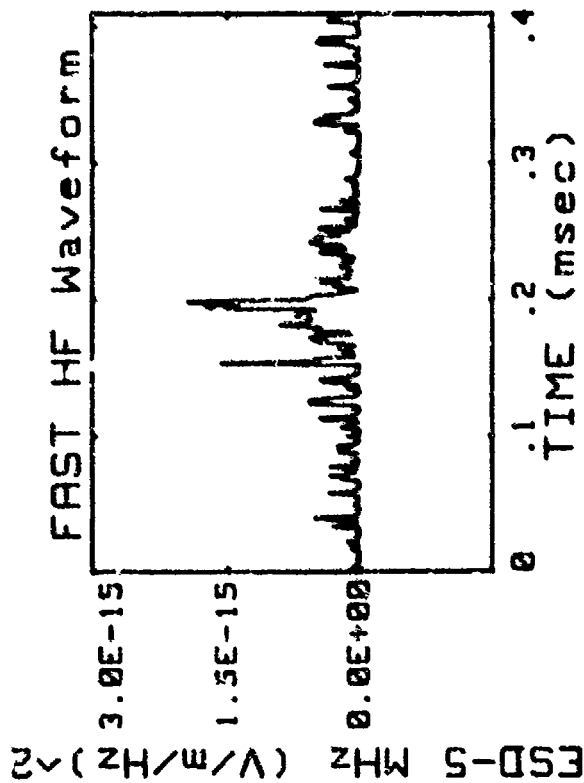
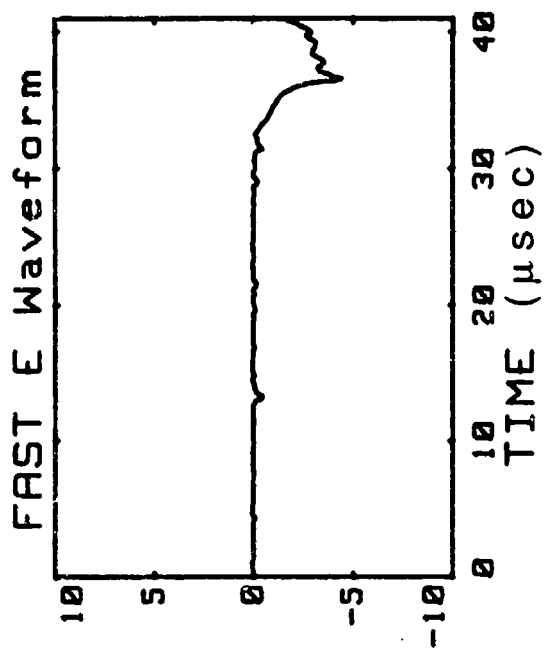
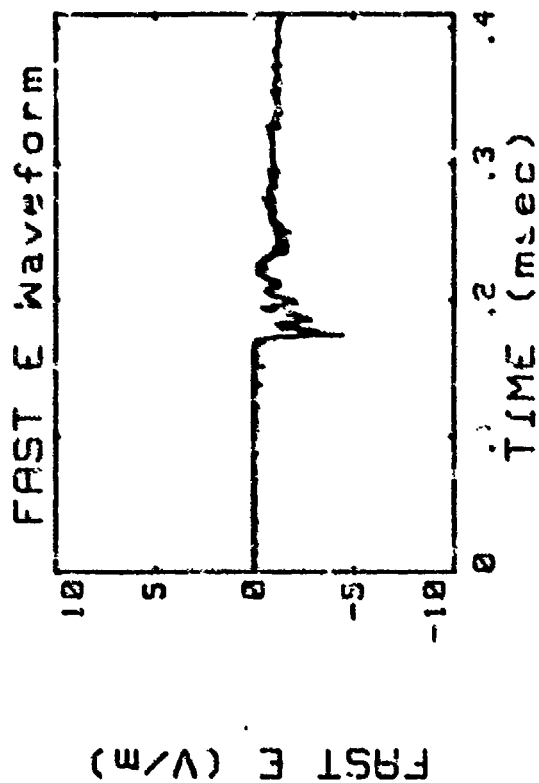
222173415.459 1985

Char Cloud Pulse (19.1 Km)

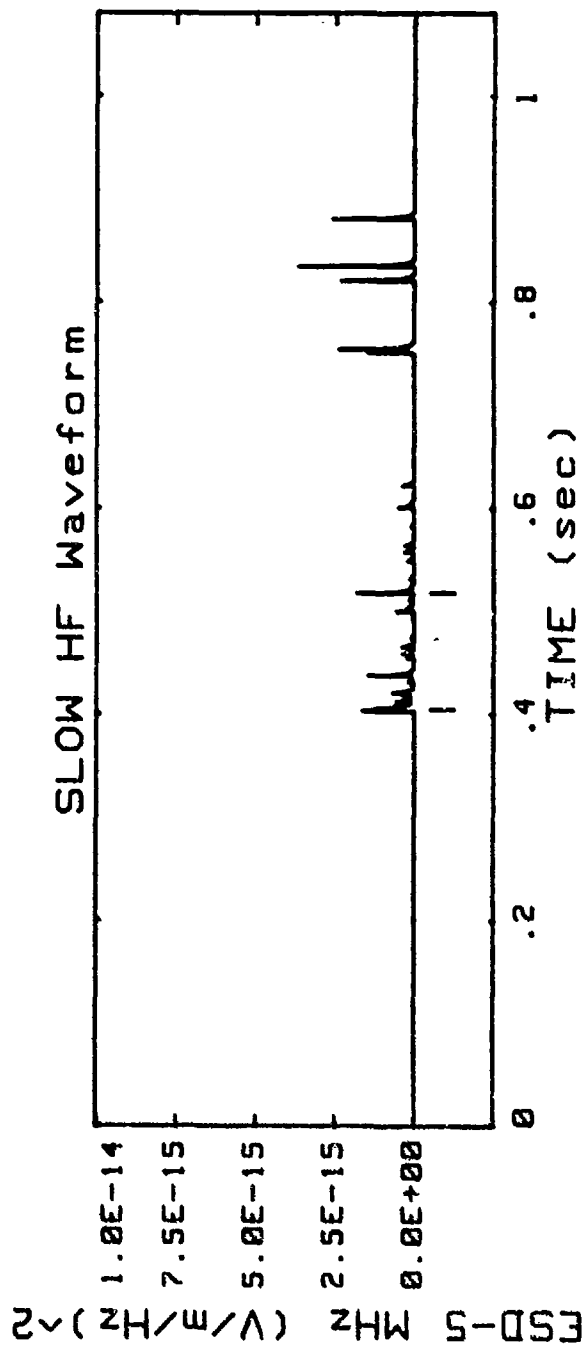
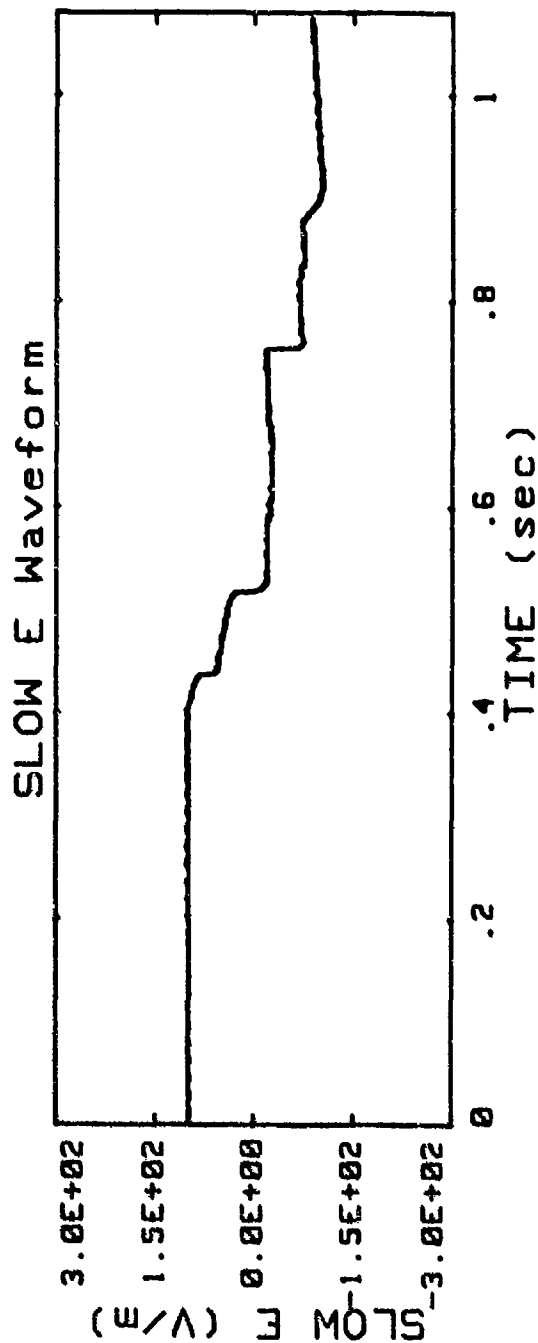


222173415.573 1985

1st RS (15.1 Km)

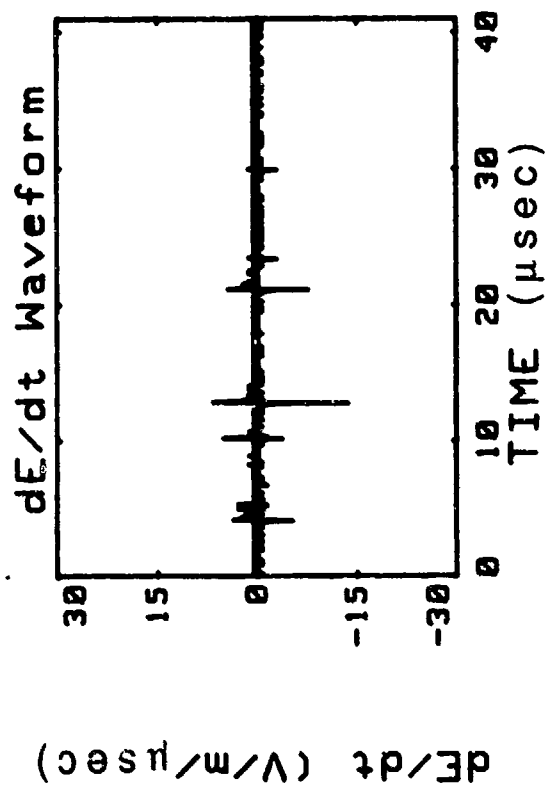
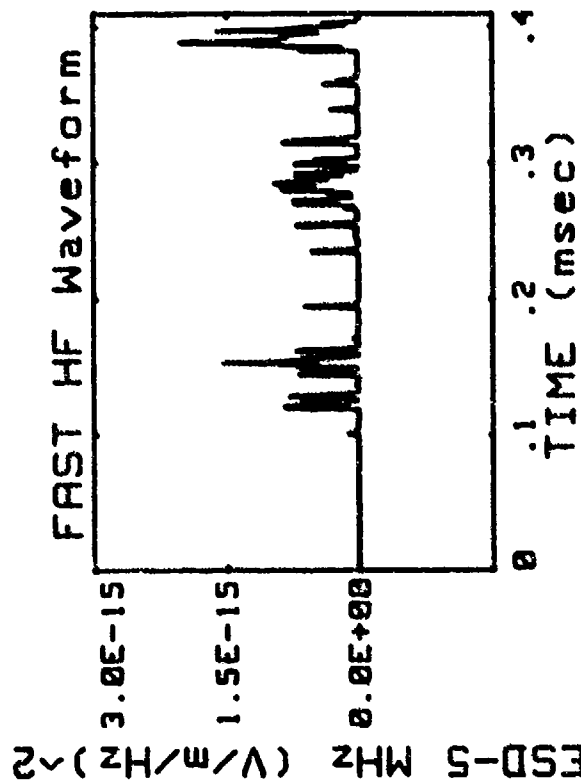
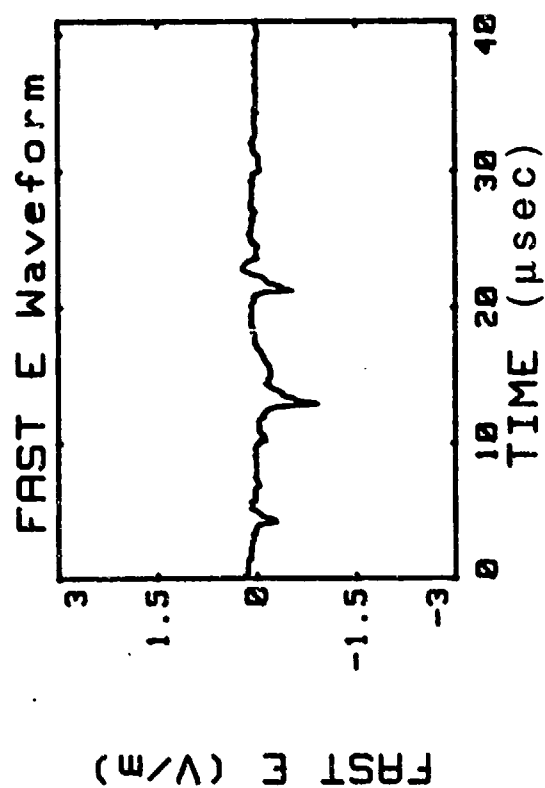
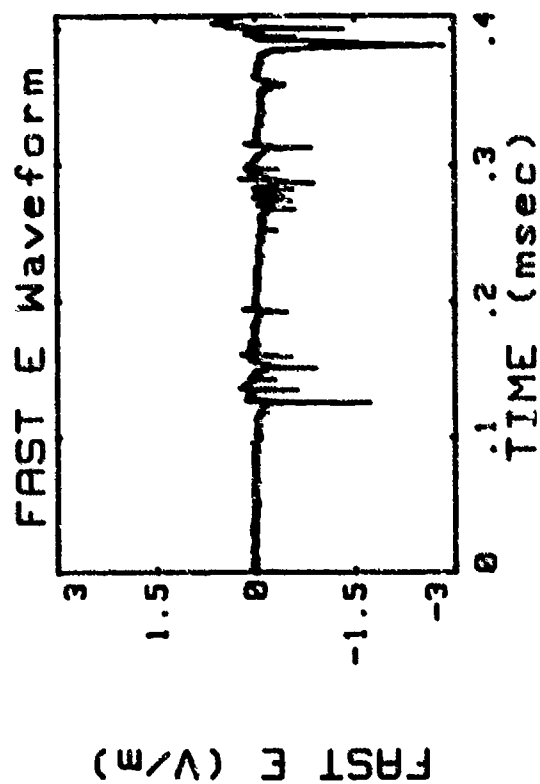


17:34:15.067 10 Aug 1985 (15.1 Km)



222173623.832 1985

Char Cloud Pulse (18.3 Km)



17:36:23.438 10 Aug 1985 (18.3 Km)

